



# FLIGHT



First Aero Weekly in the World.

Founder and Editor: STANLEY SPOONER.

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## Flight.

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## EDITORIAL COMMENT.



HERE is only one possible answer to the new German campaign of submarine frightfulness, and that is in the shape of more and yet more reprisals from the air. There is no other way in which the Hun can be dosed with his own medicine, as it were. Thanks to the British Navy the German Flag cannot show itself on any of the Seven Seas, so we cannot visit like with like in the matter of his shipping. That is all locked up in the safety of neutral ports, or as safely reposing in his own harbours behind a chain of mine-fields. If it were not so, and his ships were free to sail the ocean under the provisions of the Declaration of London of unhappy memory, can it be supposed for a single moment that Germany would have embarked upon a policy that was inevitably bound to result in reprisals? The answer is perfectly obvious. There is only one thing that is dreaded by the coward and the bully—retaliation. Germany has shown by her acts in this war that she is both. By the destruction of peaceful merchant ships and the murder of their defenceless crews, she has more definitely than ever put herself outside the pale of civilisation and must be fought with her own weapons. It is not as though the German people were not of the

same mind as their rulers. If they were not, and there were even the smallest reason to suppose that as a mass they deprecated the policy of indiscriminate murder to which they have been committed, it would be different. We could rest content until the end of the war and victory had placed in our hands the prime authors of the outrages. But we know that the German Government has behind it the united public opinion of its people—unless their public prints are more shamelessly under the thumb of the Government than we have reason to suppose. All the way through the German populace has been insistent in its cry for blood and more blood, until things have arrived at a pass when we simply cannot afford to allow the dictates of mere humanity to stand in the way of the accomplishment of our aims. It is very distasteful to have to make use of such a phrase as this, but, after all, we are dealing with facts—and tragic facts at that. Therefore we have used the term advisedly and on consideration, having deliberately arrived at the conclusion that "humanity" has no longer any place in this war. The Germans are crying out for the murder of our people, without distinction of age, sex or calling, and there is only one method of answering the call.

As we have said, we cannot hit the Hun at sea, for there he dare not show himself. But we can hit him where he lives—in his cities and towns. We have the air power, and it can be done if we seriously set out to do it. As a matter of fact, the official *communiqués* of the past week have shown that air raids on German towns are not only possible, but are actually being carried out on a suggestive scale. Moreover, they do not always appear to have taken place over "defended areas," so that these raids appear to be more in the nature of reprisals than as operations designed for military effect pure and simple. We do not know whether they have, in fact, been carried out by way of reprisal for Hun frightfulness in the Allies' countries or at sea, but whatever the intention we are unfeignedly glad that at last the war is being brought home to the German populace in their own proper persons and bodies. It is the only way in which German public opinion can be brought to see that "frightfulness" is only profitable and amusing when it cannot be returned. It cannot be helped if innocent civilians are killed in the course of these reprisals, for we no longer can afford to regard any German as less blood-guilty than another. The individual German cares nothing at all for the murder of our own and our Allies' civilians, and it is time we took off the gloves in real earnest.



## The Case for the Large Aeroplane.

The discussion on Mr. Handley Page's paper bearing this title, before the Aeronautical Society, was principally notable for the great diversity of the opinions expressed. At the same time, Mr. Handley Page may be said to have proved his case, so far as it is possible to prove it at this present moment. It does not at all follow that, even though it is conceded that the future will lead to a tremendous development in the large machine, that that development must of necessity be altogether at the expense of the smaller type, and that, we think, is where some of those who took part in the discussion went a little wrong. We can take it as read that, within the limits which will readily suggest themselves to the interested reader, the future of aerial transport will lie with the large machine, for the reason set forth by the author of the paper that the larger the machine the greater the useful load that can be carried. As he pointed out, for future commercial developments, the large machine scores with plenty of room for passengers to sit in comfort or mails or luggage to be carried, and with its steadier movement will afford greater comfort to those who travel by it. Then there is the question of certainty in operation. The large aeroplane will enable engines to be built more heavily in order to eliminate the risks of breakdown, and multi-engined machines will be used which will be able to carry the plane on its course satisfactorily, even if one engine does break down. Of course, all these matters are governed at the moment by the fact that, with all the experience which has been gained and the improvements consequent, we are still only on the threshold of development. He would be a bold man who would venture to prophesy regarding the ultimate shape that aircraft—and particularly the aeroplane—will take. All that it is possible to say now is that, in the light of our present knowledge, the commercial future of the aeroplane will doubtless be with the large machine—large, probably beyond all our present dreams—but that the smaller types will just as probably still retain a great deal of usefulness, particularly for sport and purposes of war. That is to say, that while Mr. Handley Page proved the case for the large machine, his opponents may almost equally be said to have done the same for the smaller. Which is simply another way of saying that each has and will continue to have its individual sphere of utility.

## Mr. Pemberton Billing.

In the current issue of his own journal, "The Imperialist," Mr. Pemberton Billing, M.P., sets out to confide to his readers the story of his life. In his opening, he says that his "past," which has, as he says, been often referred to by his enemies, has been varied to a degree, full of vicissitudes, but a past of which he is not ashamed. We have read with the greatest interest the first instalment of his story, which occupies the whole of "The Imperialist," and we may say at once that, taking the story as it stands and accepting it as the naked truth, Mr. Pemberton Billing is perfectly right not to be ashamed of his past—he has every right to feel no small measure of pride in the really wonderful career that lies behind him.

We do not intend to follow him through all the vicissitudes of that career, in which he has been a veritable Pooh Bah—he has done most of the things that are open to be done by men, from bricklaying to

soldiering in many climes. To do that would occupy more space than can be spared to it in these time of paper shortage, and would, moreover, destroy some of the interest in the original story itself. We do not often go out of our way to boom another person's goods, but we do think that in this case the one who misses reading this autobiography of a man who has been much in the public eye of late will miss a real treat.

Reading the story as the author sets it down, one cannot help feeling a sincere sense of regret that a man of such versatile gifts and with so wide an experience of men and affairs should have fallen into the errors that Mr. Pemberton Billing has allowed himself to be guilty of since he devoted himself to politics and entered the House of Commons. True, those errors were largely a consequence of his having fallen amongst "new friends" out with their own axes to grind, but it does seem a thousand pities that a man with his experience and undoubted gifts, who might have rendered sterling service to the State if only those gifts had been directed aright, should have had, in vulgar parlance, his leg pulled. Whether it is too late now to retrieve the past or not it is difficult to say, but we are strongly of opinion that Mr. Pemberton Billing's story as he is now telling it will go very far to assist towards the former in the eyes of the public.

♦ ♦ ♦

## National Service.

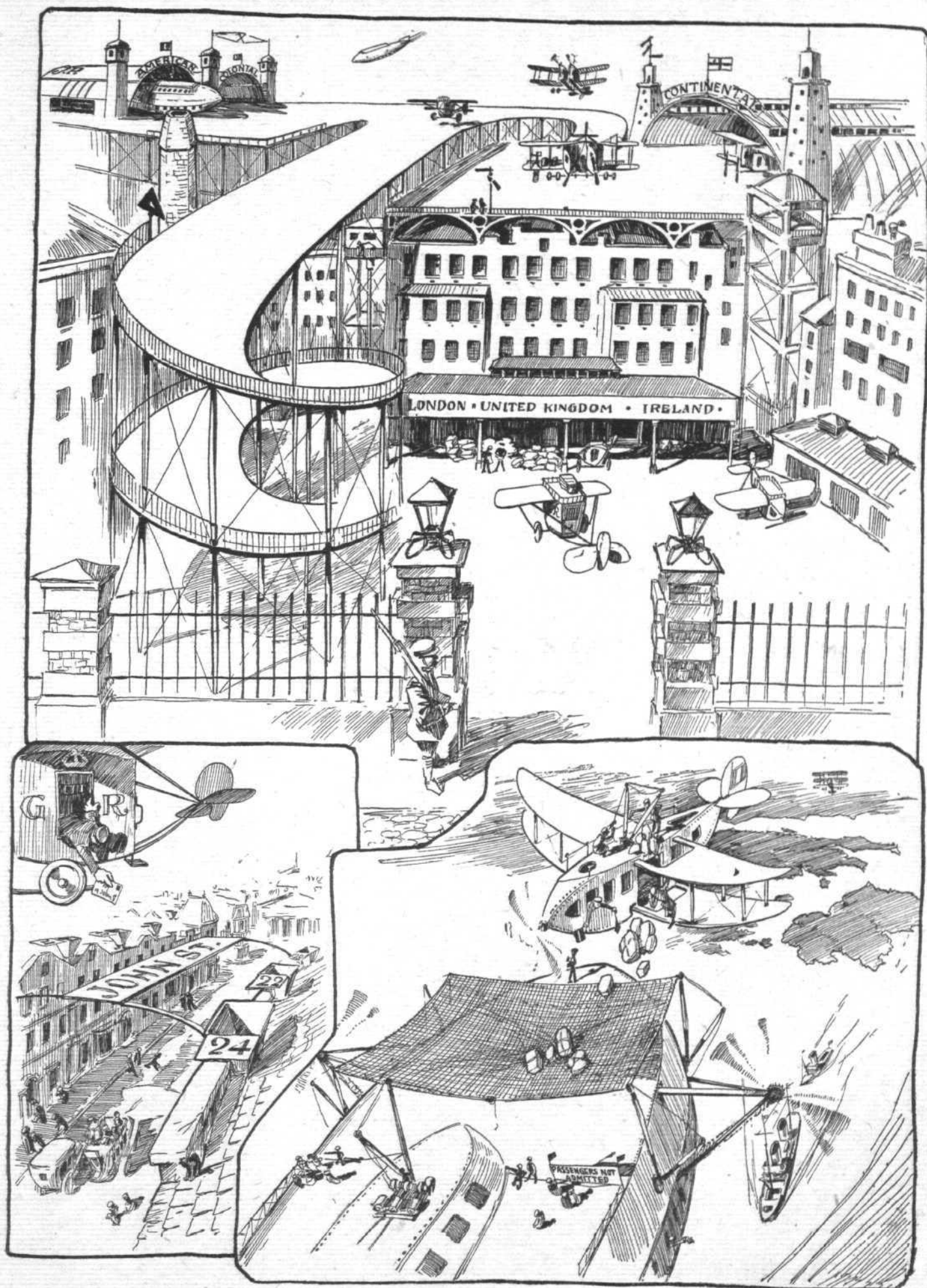
It is a sign of the times that the appeal for national service volunteers has resulted in a very large number of applications from the youngsters of under 18 to be given work in aeroplane construction. Nothing could well be more eloquent of the fact that the public at large has an unbounded faith in the future of the industry, for the reason that these youngsters are, as a rule, very largely guided in their choice of a career by their parents or guardians. It is quite easy to visualise the course through which these applications pass. The boy is keen on doing something to help along the war. He is too young to soldier, but he feels it is up to him to do *some* useful work. The question is, what? While he is about it he might as well engage in work that will offer him a career afterwards, and what better than aeroplane construction? There is a magnificent future before it, of that both he and his guardians are satisfied, so what can he do better? It is still a young industry, without too many vested interests to stand in the way of the advancement of a youngster without influence. It is not overcrowded, like most of the older businesses and professions, and thus offers scope for advancement which would be denied to him in those. Of course, all these aspects of the matter are well known to those who are intimately interested in the business, but it is only now that the general public is beginning to realise that the aircraft industry is founded on a firm and permanent basis. That this is an excellent thing for all needs no demonstration.

♦ ♦ ♦

## National Aircraft Insurance.

We note with satisfaction that the Government has announced a reduction in the rates of insurance against aircraft risk. In the case of premiums which are not reduced below 2s., 50 per cent. will be allowed until further notice from the premiums payable in respect of insurances commencing on or after the 1st of next month, and in respect of renewals





The Aerial Post of the Future.

of existing insurances falling due on or after that date. The Government reserves the right to revise the rates or withdraw the discount at any time. Discount is not to be allowed in any circumstances in respect of new insurances which come into force before March 1st, or in respect of policies which expire before that date. The announcement does not affect certificates of insurance issued by the Post Office.

We have always been of opinion that the rates charged were too high, having regard to the really small nature of the risk, but, on the principle of better

late than never, we congratulate the Government on the concession now announced. We feel that we are entitled to do so, since it was "FLIGHT" that originated and pioneered the scheme in October, 1914, which, after we had hammered away at it for months, was ultimately adopted in July, 1915, by the Government. As our readers will however remember the scheme as adopted by the Government was as an asset to the Nation. This was the alternative suggested by us, in the event of the Government not treating the whole matter as a national liability, as we strongly at the time urged it should be.

## THE ROLL OF HONOUR.

Reported by the Admiralty:—

**Previously reported Missing, now reported Died as Prisoner of War.**

Flight Sub-Lieut. W. H. Hope, R.N.

**Accidentally Killed.**

F 18675 1st Grade Aircraftsman H. W. Everest.

F 874 Leading Mech. A. Fraser.

F 1296 Leading Mech. F. G. Sims.

**Died of Injuries.**

F 8938 1st Grade Air-Mech. W. D. S. Dawes.

**Missing, believed Prisoner of War.**

Flight Sub-Lieut. G. L. Elliott, R.N.

**Missing.**

Flight Sub-Lieut. W. E. Traynor, R.N.

**Slightly Injured.**

Flight Sub-Lieut. Valentine E. Sieveking, R.N.

Reported by the War Office:—

**Killed.**

2nd Lieut. N. M. H. Vernham, R.F.C.

2nd Lieut. H. L. Villiers, Dragons, attd. R.F.C.

**Died of Wounds.**

2nd Lieut. A. H. Steele, R.F.C.

1396 Sergt. T. Mottershead, R.F.C.

**Previously reported Wounded, now reported**

**Died of Wounds.**

Lieut. J. W. Boyd, Can. Inf., attd. R.F.C.

**Previously reported Missing, now reported Died of Wounds as a Prisoner of War in German hands.**

2nd Lieut. G. S. Hall, R.F.C.

**Wounded.**

Capt. G. M. Boumphrey, R.F.C.

Lieut. K. B. Brigham, R.F.A., and R.F.C.

2nd Lieut. A. B. Coupal, R.F.C.

Capt. W. G. S. Curphey, M.C., R.F.C.

Capt. L. Findlay, Highland L.I., attd. R.F.C.

2nd Lieut. H. M. Massey, Sherw. For., and R.F.C.

Capt. G. M. Moore, R. Berks, attd. R.F.C.

2nd Lieut. H. G. White, Buffs (E. Kent), attd. R.F.C.

10726 1st Class Air-Mech. A. Best, R.F.C.

16398 2nd Class Air-Mech. W. J. Callaghan, R.F.C.

24977 Sergt. J. Drew, R.F.C.

**Previously reported Missing, now reported Wounded and Prisoner of War in German hands.**

Lieut. D. W. Davis, Can. Gen. List., attd. R.F.C.

**Missing.**

2nd Lieut. H. R. Blythe, R.F.C.

2nd Lieut. G. W. B. Bradford, R.F.C.

2nd Lieut. F. H. Bronskill, R.F.C.

Capt. C. M. Carbert, M.C., Can. Inf., attd. R.F.C.

Capt. A. P. V. Daly, Con. Ran., attd. R.F.C.

Lieut. D. J. McRae, Can. Inf., attd. R.F.C.

Lieut. P. W. Murray, Durham L.I. and R.F.C.

2nd Lieut. S. Smith, R.F.C.

2nd Lieut. E. D. Spicer, R.F.C.

2nd Lieut. R. T. Whitney, R.F.C.

14454 Corpl. R. D. Fleming, R.F.C.

19 Flight-Sergt. W. G. Webb, R.F.C.



### Honours for the R.F.C.

In a supplement to the *London Gazette*, issued on the 13th inst., it was announced that His Majesty the King has been graciously pleased to make the following awards in recognition of gallantry and devotion to duty in the field:—

*Military Cross.*

2nd Lt. (Temp. Lt.) E. L. BENBOW, R.F.A. and R.F.C.

For conspicuous gallantry in action. He has on several occasions displayed great courage and skill, and has destroyed four enemy machines under difficult conditions.

2nd Lt. (Temp. Capt.) J. C. CALLAGHAN, R. Muns. Fus. and R.F.C.

For conspicuous gallantry in action. He displayed marked courage and skill on several occasions in carrying out night bombing operations. On one occasion he extinguished a hostile searchlight.

Lt. (Temp. Capt.) A. R. S. CLARKE, Dorset R. and R.F.C.

For conspicuous gallantry in action. He carried out successfully and quickly some artillery registration that was urgently needed. He has previously on very many occasions shown great courage and skill.

Temp. Capt. J. B. QUESTED, R.F.C.

For conspicuous gallantry in action. He manoeuvred his machine with great skill, and thereby enabled his observer to bring down a hostile machine. He has on many previous occasions displayed great courage and ability.

Capt. E. S. ROGERS, R.G.A., attd. Anti-Aircraft B.

For conspicuous gallantry in action. He showed marked courage and coolness in destroying an enemy aeroplane while his guns were under heavy and accurate shell fire. He set a splendid example throughout.

*Bar to Military Cross.*

2nd Lt. (Temp. Lt.) G. W. M. GREEN, M.C., Gen. List and R.F.C.

For conspicuous gallantry in action. He brought down two enemy machines on successive days under adverse circumstances. He has displayed great dash and courage at every opportunity.

Lt. (Temp. Capt.) J. W. WOODHOUSE, M.C., R.F.C., S.R.

For conspicuous gallantry on three occasions in attacking Zeppelin airships over land and sea.

*Meritorious Service Medal.*

3270 Sergt. J. W. TODD, R.F.C.

**Mentioned in Despatches.**

A SUPPLEMENT to the *London Gazette* issued on February 8th contained a despatch from Lieutenant-General the Hon. J. C. Smuts, Commander-in-Chief, East African Force, bringing to notice, for meritorious service in the field, the following names of members of his forces:—

*Royal Naval Air Service.*—Robinson, Temp. Flight-Sub-Lieut. J., Naval Wing; Stewart-Dawson, Temp. Flight-Sub-Lieut. N. G., Naval Wing; Russel, No. 226512 C.P.O., 3rd Grade, H.; Brooke, No. F. 7963 Leading Mech. S. A.; Chapple, No. E. 7181 P.O. Mech. W. A.

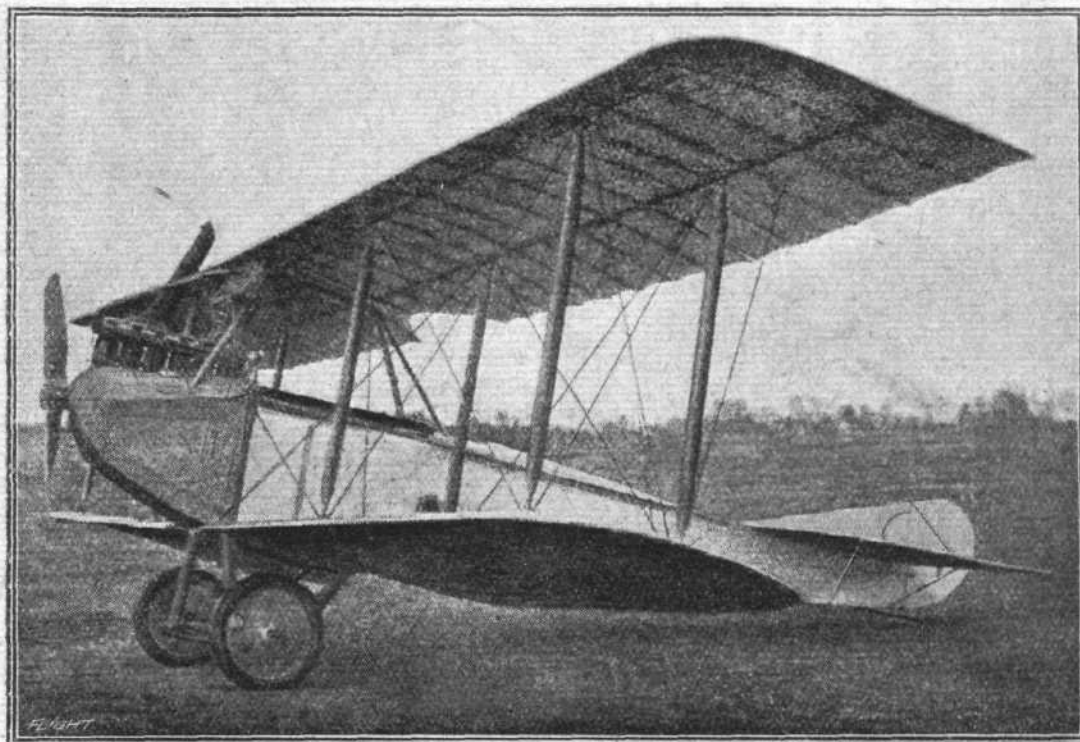
*Royal Flying Corps.*—Van der Spuy, Temp. Capt. K. R., M.C., Gen. List; Walmsley, 2nd Lieut. (Temp. Lieut.) L., E. Yorks. R.; McKiever, 2nd Lieut. A. V., Sea. Highrs. Collender, Temp. 2nd Lieut. G. F. F., Gen. List; Willis, No. Z2 Flight-Sergt. H. L.; Duncan, No. Z42 Flight-Sergt. (Acting Sergt.-Maj.) S. N.; Grant, No. Z185 Flight-Sergt. D.; Rae, No. Z76 Sergt. R. M.; Reynolds, No. Z222 Sergt. A. E.; Hamblin, No. Z98 Corpl. A. A.; Mathieson, No. Z151 1st Class Air-Mech. A. H.; Firth, No. Z225 1st Class Air-Mech. T (deceased).



## THE AVIATIK BIPLANE—1916 TYPE.

UNDER present conditions it is naturally a matter of considerable difficulty to obtain detailed information concerning enemy aeroplanes. Even when one of these is brought down intact behind our lines—which is not, unfortunately, very frequently the case,

Aviatik biplane—for the photos. of which we are indebted to our contemporary *L'Aérophile*—in the present issue brings our list practically up to date—at any rate up to the latter part of 1916—and during the present year we shall endeavour to keep

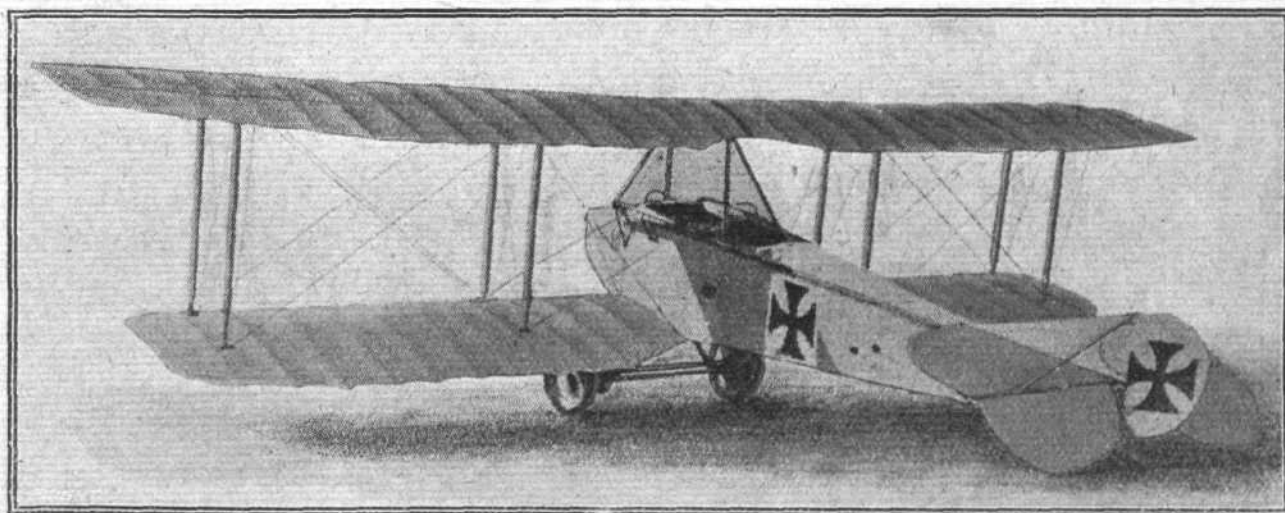


Three-quarter front view of the 1916 Aviatik fighting biplane.

as the greater part of the fights in the air take place beyond the lines, and therefore the enemy machines, when brought down, generally hit behind their own lines—some considerable time must necessarily elapse before our own and the French military authorities have finished their examinations and the machines become available for other inspection. We have, however, been fortunate enough, in spite of the

our readers as well informed regarding the German 1917 types as we have done with the 1916 types in the year just gone by.

In the 1916 type Aviatik biplane the body is of the wood girder variety, covered with fabric at the rear, while from the nose to a point behind the engine, the covering is aluminium. In section, the body is rectangular, and differs from earlier types in that the



Three-quarter rear view of the 1916 Aviatik fighting biplane.

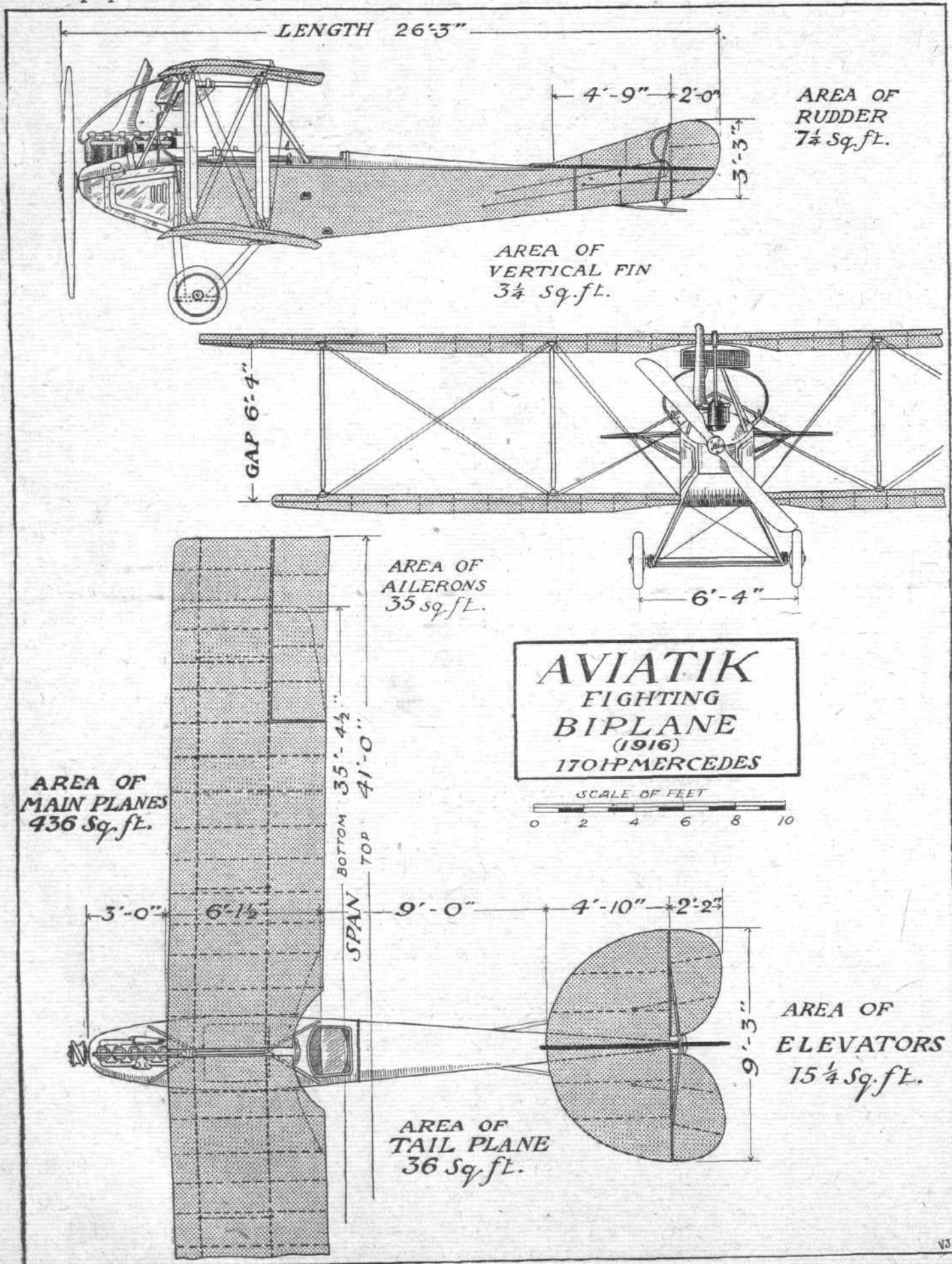
difficulties indicated, to obtain facilities for examining several of the enemy planes from time to time, and have in this way been in a position to publish detailed descriptions illustrated by photographs and sketches, as well as scale drawings, of such German machines as the Albatros reconnaissance biplane, the Fokker monoplane, the Albatros fighting biplane and the L.V.G. fighting biplane. The description of the

upper *longerons*, or rails, are no longer parallel to the line of thrust as they were, but slope down gradually towards the stern post and somewhat abruptly towards the nose of the *fuselage*.

Diagonal wire bracing is employed, and the wiring plates at the point where the struts abut on the rails are shown in one of our sketches. This wiring plate, for which, by the way, the Aviatik firm hold a patent,

consists, as will be seen, of a single sheet steel clip totally surrounding the rail and bolted together where its two ends meet, so as to grip the rail. No strut socket is employed, the strut being prevented from slipping by the simple means of punching the metal of the clip upwards in the shape of four small triangles,

which project into the end of the strut. In front the four rails converge but do not quite meet, the extreme nose of the body being formed by a steel capping plate having lightening holes cut in it. On this end plate, and two more further back, rest the two longitudinal ash engine bearers, further rigidity being obtained



THE 1916 AVIATIK FIGHTING BIPLANE.—Plan, side and front elevations to scale.

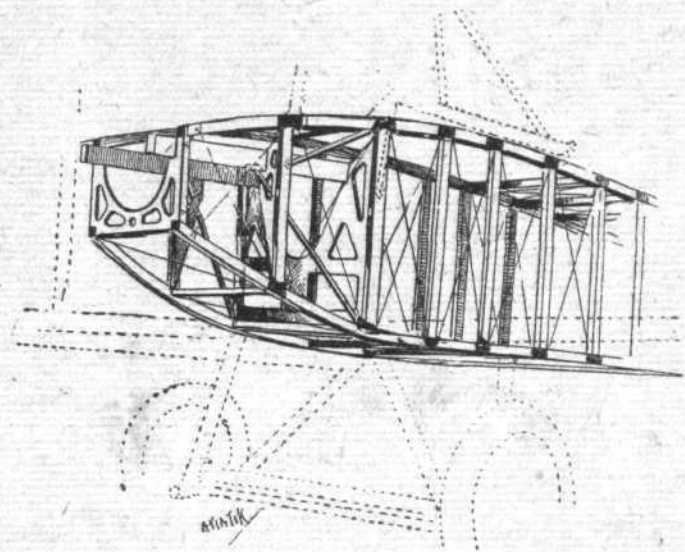


by bracing the engine bed with steel tubes from the body rails.

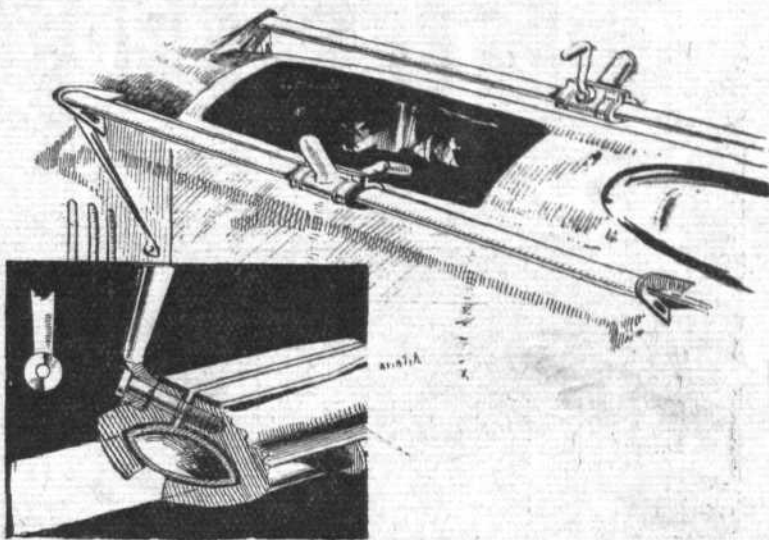
Immediately behind the engine is the gunner's cockpit, while still further towards the rear is the pilot's seat. This arrangement is rather different

sketches. In order to compensate for the difference in distance according to whether the gun is near the centre or at the ends of the rail, the gunner's cockpit is of rectangular form, thus allowing him a certain amount of movement forward and backward.

On each side of the gunner is a large petrol tank



Skeleton view of the fore part of the fuselage, showing the ply-wood engine bearer supports on the 1916 Aviatik biplane.



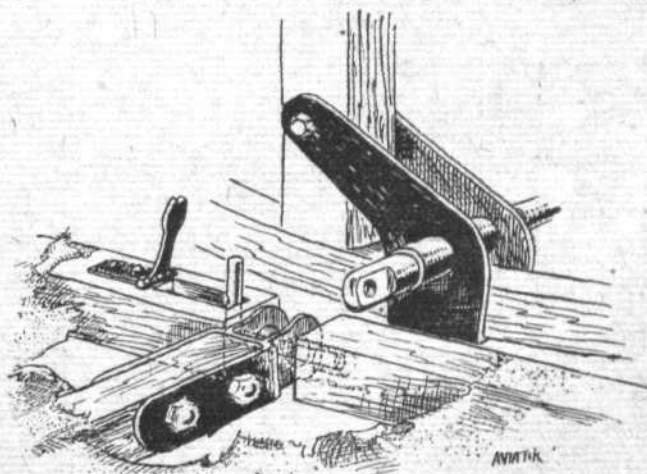
General arrangement and detail of the gun mounting on the 1916 Aviatik biplane.

from that usually found in German machines, where generally the pilot is in front, as, for instance, in the Albatros fighting biplane and in the L.V.G. It would appear that the gunner's movements must be somewhat hampered, enclosed as he is between struts, wings, &c. Along each side of the body runs a tubular rail mounted on brackets on the side of the body. The gun mounting itself is free to slide along these rails, and can be locked in position by means of a cam operated by a handle as shown in the

each containing about 24 gallons of petrol. Mounted on the front struts supporting the upper plane is a small service tank to which petrol is fed from the two main tanks by means of a small propeller-driven pump, a hand-pump being provided in the pilot's cockpit for emergencies. A fourth small cylindrical tank is mounted underneath the motor, an air pressure being maintained in it by a small pump driven off the cam shaft of the engine. Needless to say, such an arrangement of tanks necessitates a very complicating feed and pressure arrangement, and provision has been made for running the engine on the contents of one of the tanks in case the others have been pierced



The 140 h.p. engine, and chassis of the Aviatik fighting biplane.



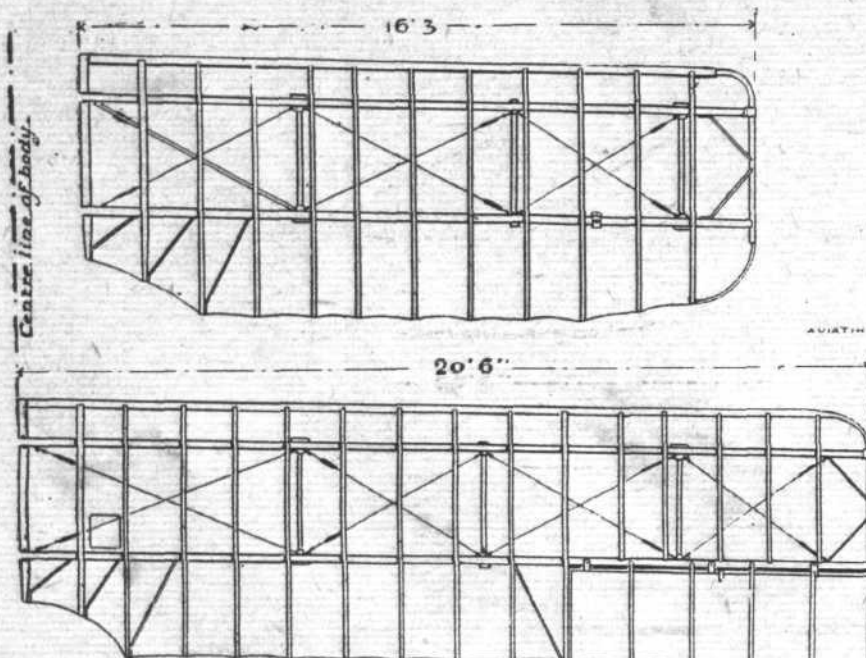
The attachment of the lower plane to the fuselage on the Aviatik biplane. A fork on the wing spar engages with the eye of the tubular cross-member mounted on the fuselage, and a pin, for which a slot is cut in the inner rib of the wing, holds them in place. The pin is locked by means of a spring clip.

by projectiles. Between them the tanks have a capacity of 55 gallons of petrol.

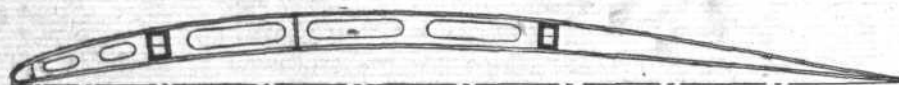
As already mentioned, the engine—a Mercedes of about 170 h.p.—is mounted on ash bearers in the nose

of the body. A large portion of the cylinders projects through the covering, and must hamper the gunner's view very considerably, especially as the exhaust collector rises up above the top plane. The radiator

carriage. The two front chassis struts are cross-braced by means of cables, eyebolts into which the cables are spliced doing service as terminals and strainers at the same time by passing through the



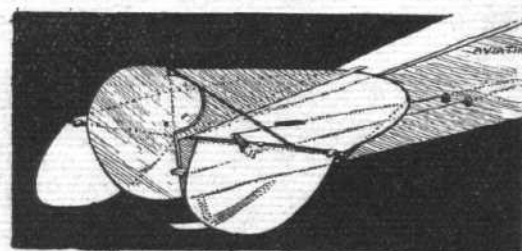
The general arrangement of the upper and lower planes of the 1916 Aviatik biplane.



The wing section of the 1916 Aviatik biplane.

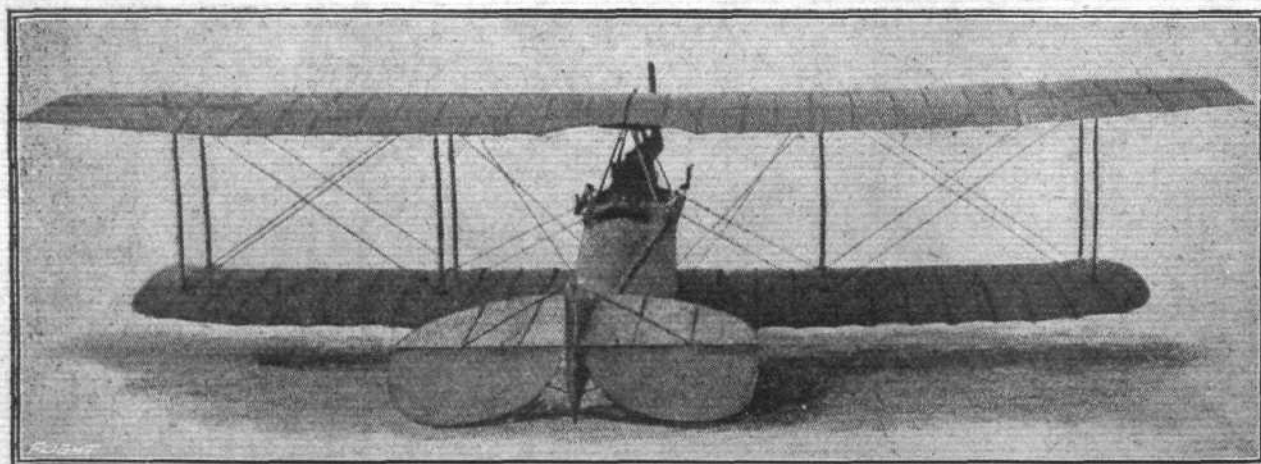
is no longer, as in the earlier types, mounted on the sides of the body, but supported on brackets on the front struts of the *cabane*, yet not let into the top plane as is the case with that of the L.V.G. biplane. The oil tank, which has a capacity of about  $4\frac{1}{2}$  gallons, is placed above the reserve petrol tank, on the left side of the engine. In conformity with general modern German practice the under-carriage is of the simple Vee type, differing, however, from the majority of other makes in that the front and rear chassis struts do not quite meet at the bottom, where they are attached to a short horizontal tube which serves as an anchorage for the shock absorbers. The latter consist of rubber rings, one strand of which is taken below the axle instead of above it in order to form a buffer between the axle and the elliptical tube connecting the apices of the two Vees of the under-

lower horizontal—or skid—portion of the chassis. In the rear bay of the under-carriage bracing is effected



The tail planes and balanced rudder on the 1916 Aviatik biplane.

by a single cable running across horizontally from the strut on one side to the corresponding strut on the

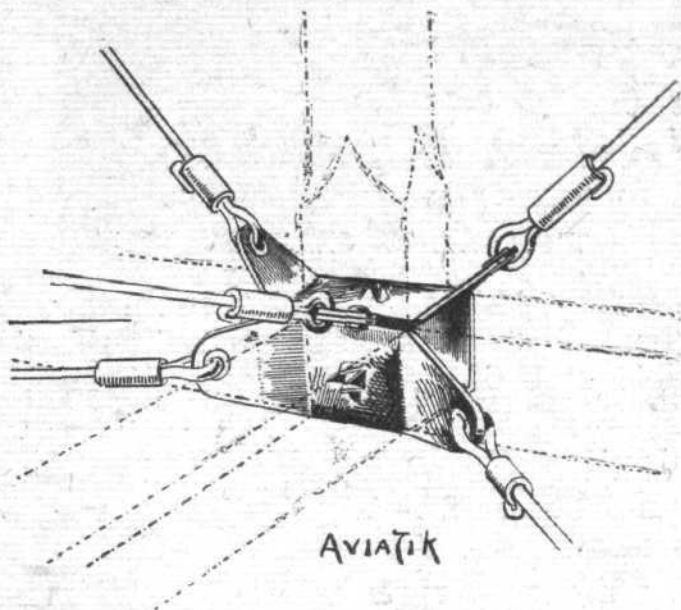


Rear view of the 1916 Aviatik fighting biplane.



other, the terminals being eyebolts similar to those used in the front bay.

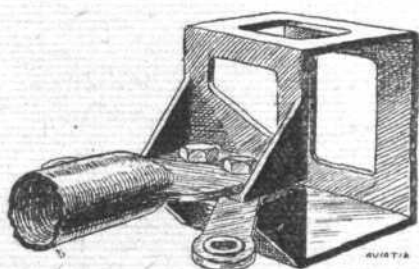
The controls are of the usual type, consisting of a wheel mounted on the top of a vertical tube, the lower end of which is secured to a transverse rocking shaft. A short length of chain passes over a sprocket



Fuselage bracing clip on the Aviatik biplane.

on the wheel axle, and is connected to the cables, leading to the ailerons. The elevator cables pass, the upper one direct to the upper crank lever on the elevator, and the other over a pulley a short distance in front of the control column. A foot bar with heel rests operates the rudder.

In plan the main planes are of the usual Aviatik type, with the exception, perhaps, that the backward slope is less pronounced than in older types. The wings are not staggered, but both are given a slight dihedral angle, whereas in the older model the lower wing had a pronounced dihedral, while the upper wing was straight. The angle of incidence, which is

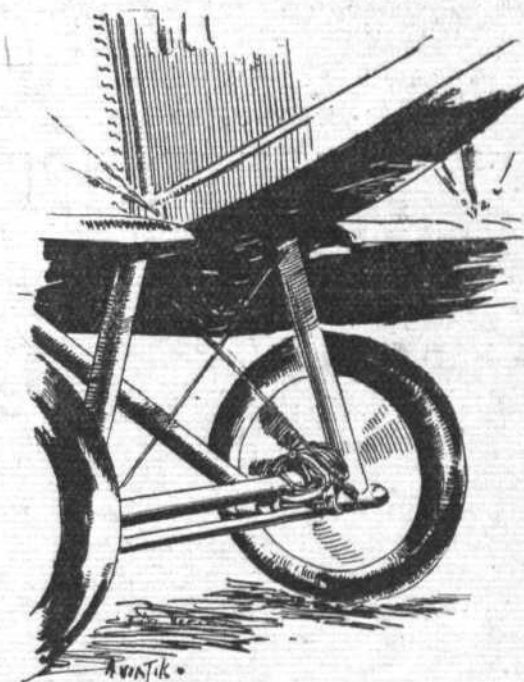


One of the metal clips carrying the tubular compression strut between the spars.

constant from root to tip, is about  $4^\circ$ , a fact which, coupled with the section employed, appears to indicate a considerable lift but no very great speed. Constructionally the wings are chiefly remarkable on account of the placing of the back spar, which is, it will be seen, placed very far forward in the section. The spars are spruce, with the exception of the upper back spar, which is of ash. They are of the box section, the two halves being spindled out and glued together, with the usual hardwood tongues. The ribs are made throughout of poplar, and the webs lightened as shown in one of our sketches. Compression struts in the form of steel tubes are placed at intervals, those occurring at the points of attachment of inter-plane struts to spars being secured to the strut fitting, while those placed between struts have their own fitting as indicated in the accom-

panying sketches. The attachment of the spars to the body forms the subject of another illustration. A short steel tube runs across and inside the fuselage, and is sweated into a collar, which, in turn, is secured to a clip passing under the bottom body rails. Into the outer end of this collar is sweated or welded a short eyebolt that passes between the forked ends of the fitting on the root of the spar. An L-shaped pin is passed through a groove in the inner rib and through the three holes, thus locking the spar to the body. This pin is prevented from slipping out by the small cover over the slot in the inner rib, which, when closed down, locks the pin in position. A similar arrangement is employed for attaching the upper wings to the four-legged cabane. The inter-plane struts are stream-line steel tubes filled with wood, a practice adhered to practically throughout this machine. The strut fitting is shown in a sketch which does not, we think, need any explanation.

The cross bracing, which is in the form of stranded cables, is somewhat peculiar, especially in the inner bay. Here the lift cables are crosses, that is to say, the one runs from the top of the front inter-plane strut to the attachment of the rear bottom spar to the body, and the other from the top of the rear strut to the root of the front lower spar. This practice appears to be generally favoured among



The chassis of the 1916 Aviatik biplane.

German aeroplane constructors, as it is incorporated also in the Albatroses and L.V.G.'s. It has, of course, the advantage of bracing the wings in a fore-and-aft direction, but must, it would seem, put a considerable stress on the inner compression strut inside the upper wing. The landing cables in the inner bay, instead of being attached to the top of the cabane, are anchored to the top body rails, as shown in the front elevation, the object probably being to provide a free movement for the machine gun.

As regards the shape of the tail planes, this will be clear from the scale drawings, but a few words concerning their construction may be of interest. With the exception of the ribs of the fixed tail plane the control organs are made of steel throughout. The fixed stabilising plane rests on the upper body rails, and as these, as already mentioned, are not horizontal,



the tail is set at a small angle of incidence in relation to the line of thrust. Underneath it is braced by four short steel tubes to the bottom body rails, and on top by two tubes running to the vertical fin.

As regards the armament of the Aviatik, there are,

in addition to the two gun mountings already referred to, two bomb tubes, one on each side of the pilot and slightly ahead of him. The bombs, of which sizes up to about 8½ ins. can be accommodated, are released from the gunner's seat by means of Bowden cables.



# The Royal Aero Club of the United Kingdom

OFFICIAL NOTICES TO MEMBERS

## New Club House.

The New Club House at 3, Clifford Street, W., is now open to Members.

Luncheon and Dinner are served daily, and Bedrooms are available.

## Suspension of Entrance Fees of New Service Members.

Until further notice, Service Members will be elected to the Royal Aero Club without Entrance Fee.

## Subscriptions.

Members are reminded that the Subscription of £5 5s. for the year 1917 became due on the 1st January last. Bankers' Order Forms can be obtained on application to the Secretary.

## Servants' Christmas Fund.

The Subscription List for this Fund is now open.

## THE FLYING SERVICES FUND administered by THE ROYAL AERO CLUB.

THE Flying Services Fund has been instituted by the Royal Aero Club for the benefit of officers and men of the Royal Naval Air Service and the Royal Flying Corps who are incapacitated on active service, and for the widows and dependants of those who are killed.

The Fund is intended for the benefit of all ranks, but especially for petty officers, non-commissioned officers and men.

Forms of application for assistance can be obtained from the Royal Aero Club, 3, Clifford Street, New Bond Street, London, W.

## Subscriptions.

£      s.      d.  
Total subscriptions received to Feb. 13th, 1917 11,130 9 10  
B. STEVENSON, Assistant Secretary.  
3, Clifford Street, New Bond Street, W.

## EXHIBITION OF ZEPPELIN RELICS IN TEMPLE GARDENS.

IN aid of military charities, to which attention has already been drawn in "FLIGHT," there is now on exhibition in the gardens of the Middle Temple, Embankment, a fine series of Zeppelin relics gathered from the six or eight airships that met their fate at the hands of our aircraft defence organisation.

The exhibition will remain open for about three weeks, and those paying a visit should be amply rewarded for their trouble, and in addition help materially to increase the available funds of a most necessary and excellent institution. In addition, those more closely connected with the R.F.C., and who have the welfare of the Royal Flying Corps Hospital at heart, may directly benefit that hospital by purchasing some of the many excellent pictures on sale, the total proceeds of which will go direct to the fund.

The exhibits comprise some 150 numbers, all of which will bear closer investigation with interest. There is, in addition,

a complete Fokker, inspection of the interior of which may be obtained for a trifling fee.

Not the least important object of interest is a Beardmore engine, with its connecting story written up for everybody to read, a story of pluck and daring by one of our pilots under a series of cumulative disasters, ending in his own escape. First his observer was killed. Then he himself was shot through the foot and shoulder. Bullets pierced the induction pipes and cylinders of his engine, but he struggled on. A German "Archie" got a direct hit in with a shrapnel which shattered the prop., blew off the forward end of the crankcase and the first cylinder, besides doing damage to wings and tail-booms, yet he landed with his dead observer in friendly lines.

In addition to Zeppelin relics, there are other war trophies, comprising helmets, carbines, swords, shells, and other things, each with a particular interest of its own. Nobody should fail to pay a visit to this unique collection of "trophies."

## War Work Honours.

INCLUDED in the list of honours announced in the *London Gazette* on the 13th inst. are several names which are well known in connection with aviation. Thus, Sir Charles Cheers Wakefield, who was Lord Mayor of London last year and did such splendid work in connection with recruiting and on behalf of war charities, is created a baronet. The new knights include Mr. William Weir, the Scottish director of Munitions and Controller of Aeronautical Supplies on the new Air Board, Mr. W. A. Tritton, who has taken a prominent part in the development of the "Tanks," and Mr. E. T. Buckham, the chief gun designer to Messrs. Vickers, Ltd. Major (Temp. Lieut.-Col.) J. Norton Griffiths, D.S.O., M.P., King Edward's Horse, has been made a K.C.B., and Col. the Duke of Atholl, M.V.O., D.S.O., Scottish Horse, a C.B., in recognition of their services during the war. The Duke of Atholl is the Chairman of the Royal Aero Club, while Col. Norton Griffiths was before the war an active balloonist and a generous supporter of aeronautics.

## V.C. for an Air Hero.

It was announced on the 12th inst. that the King has been graciously pleased to award the Victoria Cross to

1396 Sergt. THOMAS MOTTERSHEAD, late R.F.C.

For most conspicuous bravery, endurance, and skill when,

attacked at an altitude of 9,000 ft., the petrol tank was pierced and the machine set on fire. Enveloped in flames, which his observer, Lieutenant Gower, was unable to subdue, this very gallant soldier succeeded in bringing his aeroplane back to our lines, and though he made a successful landing, the machine collapsed on touching the ground, pinning him beneath wreckage, from which he was subsequently rescued. Though suffering extreme torture from burns, Sergeant Mottershead showed the most conspicuous presence of mind in the careful selection of a landing place, and his wonderful endurance and fortitude undoubtedly saved the life of his observer. He has since succumbed to his injuries.

## An Air Raid Hero.

THE awards of the King's Police Medal announced on the 12th inst. included the following:—

"William Gardiner.—A station officer, London Fire Brigade. Skill and courage during an attack by enemy airships, when bombs were dropped within 150 yards of his station. Despite interruption of the fire alarm currents, he was able by intelligent manipulation of the switchboard, to find out which alarms were being pulled. He supervised the extrication of injured persons from dangerous ruins, and showed great resource in dealing with fire in a very dangerous situation before it could spread."



# Armchair Reflections by the "Dreamer"

UNTIL the mathematicians come to my assistance and prove me right, I shall have to pretend to believe that the top of the bed is the proper place for the bolster. Of course, I know perfectly well in my own mind that the correct place for this horrible contraption is at the foot of the bed, and that it is only placed at the top because it sets the arrangements off so nicely when visitors are taken upstairs to lay their hats upon the spotless napery.

In parenthesis, why it is that the gentler sex must always go up to the bedrooms to remove their outer



gear, whilst mere man leaves his in the hall, is a problem I have promised myself the unravelling of when I have successfully solved the mystery of the many who "could not possibly be bothered to bring Baby, my dear," and then carry a couple of lap-dogs with snubby snouts and sneezy colds. But that has nothing to do with mathematics and bolsters.

A weary man wants to sink his head into a soft pillow and rest, and does not require that pillow

bolstered up until he thinks he is sleeping in the road with his head on the kerb. The business of a bolster is located at the foot of the bed, and its precise work is to keep the weight of the clothes off one's feet. What man can sleep peacefully on the flat of his broad back if his toes have to perform the obligations of tent poles?

Imagination cannot picture for me a Sopwith one-and-a-half strutter flying backwards yet once upon a time machines used to fly tail first. Then the mathematician came along with his slide-rule, and his graphs and curves, and they were turned the other way about. And this is where the mathematician can help me in righting one of my pet aversions. Some day, some slides illustrating curves will be thrown upon the sheet at one of the great societies where these men gather to bother and confuse the poor brains of their patient audience, and then we shall have our bolsters placed at the foot of the bed. But you are wondering what all this has to do with aviation. Nothing very much, that is, nothing but a sequence of thoughts engendered at the reading of a paper by Mr. Handley Page at the Aeronautical Society last week.

I sat watching these curves thrown upon the sheet until I wondered, so confident did Mr. Handley Page appear in their lucidness, whether he had the sheets of his bed squared out like analysis paper, with his body-curves already plotted out for him to take up his position at night. From the sheet to the bolster is but a short curve, as you will admit. And so the thoughts.

I suppose that as one of the lectured it was my duty to appear interested in these pictures of curves and equations, but I wasn't, except in the one that got scorched up in the lantern. When I saw the scorch spreading across the sheet, I wished I could have had a sovereign (a paper one, of course) on with somebody that "Resistance in lbs." would beat "Horse-power available" by two squares in scorching its way to the margin. "Horse-power required" made a bad start and ran off the course.

Wonderful fellows, these mathematicians, but as Mr. Lanchester (who took little interest in the graphs himself) admitted later, "We work with these equations until they become familiar objects to us, and we suppose that they are equally readable to everybody else." Which no doubt would be true enough if we had more time to study them. Personally, my knowledge in such matters is not sufficiently deep to enable me to make a mental picture of them during the short time they are on the sheet.

Nevertheless, I can suppose that it is only by the use of such things in the way they were used that a lecturer can seek to introduce his subject in such a way that he can explain it, and that they serve their purpose, even though not to the extent wished.

Mr. Handley Page himself was in fine fettle, and gave a most interesting reading of his paper. The pleasure in listening to him, at least to myself, arises principally from the fact that he is just H.P. himself, eschewing all orthodox "platform" style of oratory. With regard to the photographs thrown upon the screen, they were in every way excellent, and gave a realistic idea of the gigantic machine under discussion, though the lanternist did not seem particularly happy in his tussles with his iron partner.

With regard to personal impressions gathered during the evening, I was struck with the remarkable number of young or youngish men now interested in aviation, though, apparently, they were not all quite so young as boyish looking. For instance, I had not seen Commander Longmore for about five years. At that time he looked about 20 years of age; on Wednesday, he would easily have passed for 19: I must really interview the gallant commander on the art of keeping young.

Another point was that in the discussion that followed, and even in the reading of the paper itself, when arguing the pros and cons of the big and the little 'bus, everybody seemed to argue from the war point only. Presumably this was owing to the effect that the war has on our daily lives. For there cannot be much doubt that the giant machine has a

LAP DOGS.





future before it, if not for war purposes, then for commercial use. The photograph showing many scores of men helping to start the H.P. off was rather unfortunate, and was eagerly picked up by Mr. Holt Thomas, when Mr. Page pointed out that the big 'bus only required one pilot, as against four if the carrying capacity were divided between that number of machines. Happily there was an explanation of

this special picture in the well-known fact that when a film is being taken, everybody wants to help—by getting into the photograph.

Most interesting were the photographs showing the struts vibrating when the machine was in the air, and it appears that this most instructive method of recording under trial conditions could be carried out with reference to many other parts of all machines.



IN the House of Commons the administration of the R.N.A.S. is down for discussion in the name of Captain Burgoyne.

LORD MIDLETON, in the House of Lords this week, will be handling the much-debated question of the multiplication of Government offices and officials, *alias* Bureaucracy. Whether he will be able to get anywhere remains to be seen. His enquiries, however, will leave little to be added by any one desiring a little light upon the present methods of sequestration.

THE scope of the information asked for may be gathered from the following particulars for which a return is asked:—

1. "The estimated cost of all buildings under erection or contracted to be erected for use as Government offices between January 1st and December 31st, 1916.
2. "The hotels, public buildings, or private houses bought, rented, or lent for the above purpose, showing in each case the rental, compensation, or price agreed to be paid.
3. "The number of the staff—(a) permanent; (b) temporary—now employed under the new Ministries established

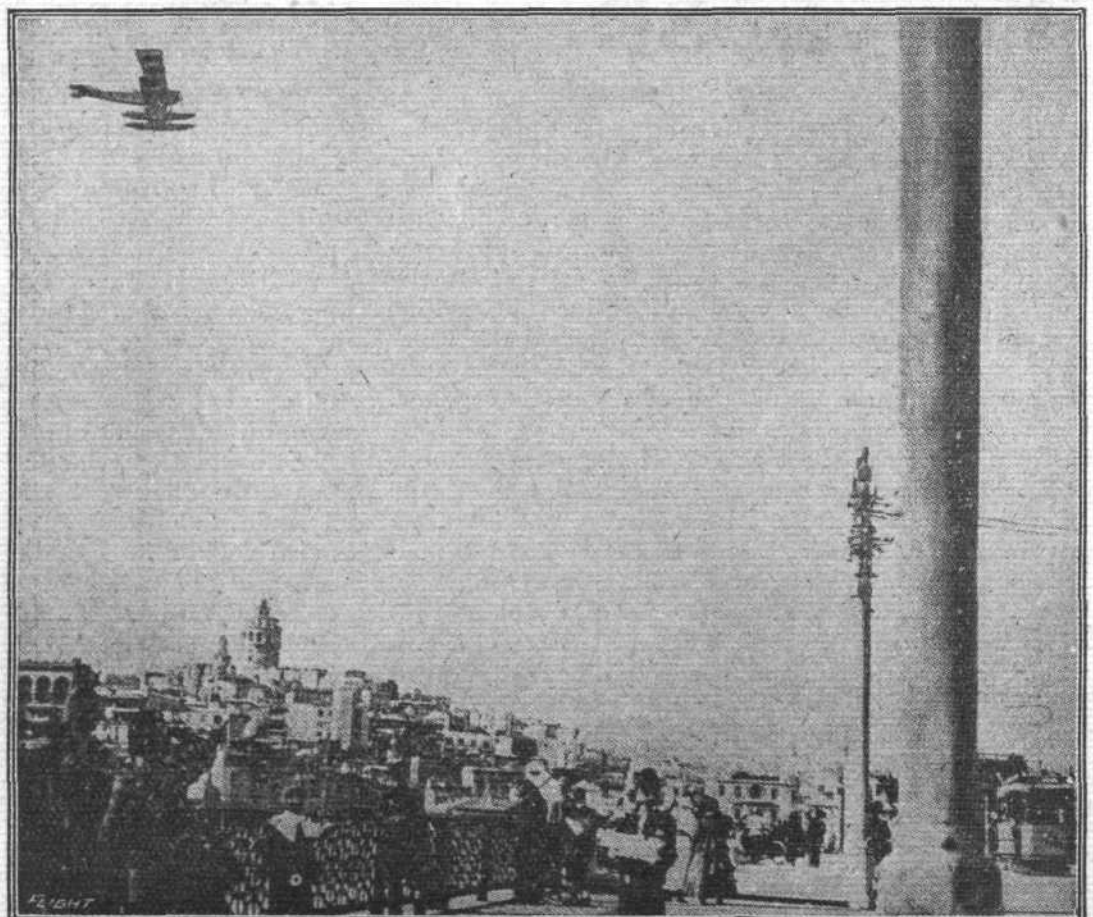
during the war, distinguishing headquarters and clerical staff from inspection and outdoor staff—namely, the Ministry of Munitions, the Air Ministry, Food Controller, Labour Ministry, Ministry of National Service; the annual remuneration of all such staff to be shown in gross in the case of each Ministry.

CONGRATULATIONS for "New Year Honours" received to Sir C. C. Wakefield, who has been made a Baronet; Major (temporary Lieut.-Col.) J. Norton Griffiths, D.S.O., M.P., King Edward's Horse, made a K.C.B.; Col. the Duke of Atholl, M.V.O., D.S.O., Scottish Horse (Yeo.), made a C.B.; Mr. William Weir, of Messrs. G. and J. Weir, and the Controller of Aeronautical Supplies, who has been created a Knight.

"THE story originated in the fertile imagination of a friend." Such is the explanation given in regard to the story which recently appeared stating that Brigadier-General Odium, who had command of one end of the Canadian front in the last attack of the Somme, flew over the enemy's lines during the battle, directing observations from the air. It sounded "Somme" story at the time.



A German (Gotha) seaplane over Constantinople.





£37 NET has been contributed by the Kaiser to a farmers' Red Cross sale at Chelmsford recently. It was hardly his own fault, though, as this was the sum realised by auction in the market, after several changings of hands, for a fragment of a Zepp. which was brought down in flames in Essex last September.

A CHANCE for any of the gentler sex who have a little time on their hands, to fill the void. Socks, mufflers, and cardigans are urgently needed by the men of the R.F.C. overseas. Lady Henderson will be most grateful for any gifts sent to her at Surrey House, Marble Arch, W.

A PERSONAL inspection of the recently-opened R.F.C. Club in Bruton Street was made by the King and Queen, accompanied by Princess Mary, last week end, attended by Commander Sir Charles Cust, Bart., R.N.

AMONGST the many urgent forms of National work open to Volunteers for National Service, are Aeroplane Construction, Motor Mechanics, and Engineering.

"AIRCRAFTSMAN" is now an accepted definition in official announcements of Naval casualties.

CHARACTERISTIC of our cousins away under is the following message which was sent from Home to the Australian Flying Corps in the war zone last Xmas:—"Fathers, mothers, wives, sisters, sweethearts, brothers, relatives and friends send loving Christmas greetings to officers and men of the Australian Flying Corps. Good luck and safe return."

A CERTAIN amount of relief should be felt by the London Chamber of Commerce in the official announcement of 50 per cent. rebate in National Aircraft Insurance premiums as from March 1st. In their recent annual report they have once more recorded their views upon this very sore point. In the past they have justly urged that damage thus caused should be a charge upon the community as a whole. The Government, they say in their report, did not see eye to eye with the Chamber, but drew up a scheme of State insurance quoting rates more agreeable than those demanded by people in the insurance line. The Chamber still considers that the rates are unnecessarily high, especially for the general community, and considers that the losses thus incurred should not be personal.

So say all of us, but unfortunately the crux of the whole thing is that the Chamber, with the rest of the public, took up the cudgels too late to impress the Government as to the general feeling.

THE Huns are at it again, ruthlessly juggling with figures as to our and their losses in the air. In the official *communiqué*, of February 9th, from Berlin the boast is made that during January the English, French, and Russians lost 55 aeroplanes in aerial fights or by the action of anti-aircraft guns, while the German losses in the same period were only 34. How far this is in accord with truth may be gauged by the fact that during January Sir Douglas Haig recorded the destruction of 21 German aeroplanes on the British front, 14 others being driven down in a damaged condition. The French Staff reported the destruction of 19. This makes a total of 40, apart from several other German aeroplanes destroyed on the Russian front.

FROM the *Wireless World* :—

"*Missed Opportunities*.—One very excellent way of learning what one owes to a certain instrument is to do without it for a while. We get a good insight into the utility of aeroplane wireless from an account recently sent home by a newspaper correspondent. It is concerned with the adventures of a subaltern in the Flying Corps who was serving in Mesopotamia at a time when he was 'monarch of all he surveyed' (i.e., when his was the only plane available). He was scouting on a machine unfitted with radio apparatus, and—as soon as he went up—noticed how at a certain height he ceased to be troubled by the shimmering mirage which in hot climates confuses the human eye and judgment of distance so long as the observer is located on the earth level. From his vantage point in the sky everything was 'clear as a bell.'

"Yonder go our cavalry and the enemy's, nearing each other in the haze totally unawares! . . . What's —'s brigade wheeling round for now? A mile further advance would turn the enemy's flank. . . . The Turks are leaving their front trenches; they're fully 3,000 strong: oh, if only I could get our gunners to shell them from across the river. . . . Now's the time; if only the cavalry would go for them! . . . What a chance they've missed!"

"Matters have been amended now, and the British air ascendancy in Mesopotamia is at present as complete as it is in France. The machines are of the latest pattern, and aeroplane wireless keeps the pilots and observers in the sky in close touch with the artillery commanders and army leaders beneath them. The erection of hangars has reduced the wastage of aircraft by giving protection against the alternate sun-baking and rain-drenching to which the machines were subjected in the earlier stages of the campaign.

"The scraps of the flying man's remarks, from which we have just quoted, speak eloquently of missed opportunities which would not have been let slip had wireless been available."

ONE would have thought the above story would have appealed to most folk without any further elaboration, but there is a *Wireless World* moral added, which endeavours to carry us even a bit further than the Horizon of the Wireless Waves. Thus continues our contemporary: "And may not this position of the hovering observer, chafing at being unable to communicate with his comrades below, give us some hint as to what perchance is happening in an unseen world? May it not be that those who have 'passed over,' crossing the 'bourne from which no traveller returns,' look down upon the scene below, unaffected by the mirage of earthly bonds, and longing for some means of communication whereby they may radiate timely warnings of 'lost opportunities' to their loved ones still battling in this world of sense?"

So far the application of Mr. Pemberton Billing, M.P., for the Chiltern Hundreds has not materialised, though he has organised several meetings for his constituents to express confidence in him. P.B.'s considered point is that he is prepared to resign his seat in Parliament unless he is satisfied that he retains the full confidence of all his constituents, which is a little different to what was attributed to him in the first place, following the unsuccessful termination of his action against *The Globe*. As there are already, in the persons of Mr. Herbert Metcalfe, barrister, and Mr. E. B. Barnard, Chairman of the Metropolitan Water Board, two Richmonds in the field ready to do battle for the seat against "P.B." should he seek re-election, it may be that Mr. Billing will decide that he does still retain the confidence of the electors. It certainly would be no walk-over for him this time if he trusts once again to the ballot box.

In the meantime, the House is likely to have a second flying member within its precincts shortly, as a result of Mr. Sidney H. Goldsmid, Unionist candidate for North-East Bethnal Green, having deemed it necessary to resign his candidature in consequence of his duties with the Red Cross in France, as well as in the Ministry of Munitions. Mr. A. Baldwin Raper, of the firm of C. Peto Bennett, merchants, who is at present serving in the R.F.C., has been unanimously selected as the candidate in succession to Mr. Goldsmid.

STILL another attraction was added last week to Lady Drogheda's delightful Aircraft Exhibition at the Grosvenor Gallery, in Lieut. Warneford's original aeroplane, on which he brought down the first Zeppelin. This has been lent by the Admiralty. Its advent has caused quite a rush of the public, and some notable visitors have taken their turn in going round the exhibits, including the Duke of Connaught, Lord and Lady Cowdray, Duchess of Marlborough, Lord Blandford, Earl and Countess of Pembroke, Lady Juliet Duff, &c., &c. The funds for which Lady Drogheda has worked so hard should obtain substantial benefit by the time the show closes, as, in addition to the daily gate-money, a number of generous donations have been made, amongst which may be noted from Mr. Holt-Thomas, Aircraft Co., Ltd., £50; C. G. Spencer and Sons, Ltd., £26 5s.; the Aircraft Supplies Co., Ltd., £10 10s.; Gordon Watney and Co., Ltd., £50; British Caudron Co., Ltd., £5 5s.; Sopwith Aviation Co., Ltd., £50; G. P. Peters and Co., Ltd., £10 10s.

Intending visitors should not delay, as about another fortnight will see the exhibition's close, which in the meantime is open from 10 to 6 each day at the modest entrance fee of 1s.

#### TEN YEARS AGO.

Excerpts from the "Auto." ("FLIGHT's" precursor and sister journal) of February, 1907. "FLIGHT" was founded in 1908.

M. SANTOS DUMONT.

M. Santos Dumont is nearly ready with his new aeroplane, which, as we have previously indicated, has its lifting surfaces constructed entirely of wood, instead of the canvas used in the construction of the "Bird of Prey." His future experiments will be carried on at Saint Cyr, for which he has obtained the necessary permission from the military authorities.



# Answers to Correspondents.

[As a number of letters reach us signed with initials only, some of which do not give a complete address, we would point out that such communications cannot be dealt with in our columns. Full name and address, which will not be published, must always be given.—ED.]

**T. N. McE.** (Cricklewood).

We regret that we are unable to give you any information concerning the meaning of the letters Bu on the Albatros scout. We do not know of any book of scale drawings of aeroplanes, but if you will look through back volumes of "FLIGHT" you will find scale drawings of nearly all the more important machines built up to the outbreak of war.

**"Mac"** (South Shields).

The speed of modern seaplanes varies from 70 m.p.h. to about 105 m.p.h., and that of modern aeroplanes from 90 m.p.h. to 150 m.p.h. We have no plans of the scale model tractor you refer to, and to produce "a diagraphm of a seaplane and an aeroplane, showing exactly every part with the exception of the motor," would entail more work than we can afford at the present moment. By looking up back numbers of "FLIGHT" you will find a number of scale drawings of land machines as well as seaplanes.

**H. C. A.** (Horsham).

The employment of a small propeller working windmill fashion for driving an electric generator does not, as you quite correctly suppose, make a very efficient drive. As against a direct drive from the engine, there is first, in the case of the windmill drive, a loss amounting usually to some 25 per cent. in the efficiency of the aeroplane propeller. Then there will probably be an equally great loss in the small propeller acting as a windmill, so that all told such a drive is very inefficient. The power required to drive a generator is usually, however, so small in proportion to the horse-power of the engine, that the loss in efficiency is not such a serious matter as might be expected. The windmill drive has the advantage that it is easy to fit without interfering with the engine in any way. For a very large generator the direct drive would probably be preferable.

**L. M.** (Plaistow).

The power available for driving other machinery is that delivered by the engine to the belt on its driving pulley, or, if direct drive is employed, that delivered at the engine shaft. Since this power is usually measured by some sort of brake, it is generally known as the brake horse-power, abbreviated to B.H.P. In any machine the ratio

$$\frac{\text{useful work}}{\text{total work of effort}}$$
 is called the efficiency of the machine. In the case of an air-screw the efficiency is

$$\frac{\text{h.p. delivered by air screw}}{\text{b.h.p. of engine}}$$

For (example, if the brake horse-power of an aero engine is 100 and the useful work done by the air-screw is equivalent to 80 h.p., the efficiency of the air-screw is obviously  $\frac{80}{100} = 80$  per cent.

The Zeppelin airships are equipped with a wireless installation, and, provided his instrument is "tuned" to the same pitch, an English wireless operator can pick up the message, but for communications of any importance a secret code is always employed. There are no examinations of the kind you refer to. If you are over 18 years of age you can apply for a commission in the R.F.C. or R.N.A.S.

**J. J. M.** (Byfleet).

The fact that the water in an aero-radiator boils when running the engine for a considerable period whilst the machine is on the ground does not necessarily prove that the body of the aeroplane is not in the slip-stream. When the translational speed of an air screw is zero, in other words when the machine on which it is mounted is standing on the ground, the air screw is no longer acting as a propeller, but as a fan, and may be very inefficient in this capacity. It is quite possible that where the inner portion of the blades of a tractor-

screw are acting merely as supporting arms for the blades and not designed to give any thrust, the effect of the slip-stream on the body may be considerably reduced, and that therefore any loss in thrust, due to a smaller portion of the blades doing useful work, may be compensated for by the attendant diminution in the velocity in the portion of the slip-stream surrounding the body. The problem is an interesting one, and might with advantage be discussed further. For this, however, we cannot find space in the A. to C. column. The thrust of a propeller cannot be calculated from the data you give, as the most important factor—the power of the engine—is not stated. If the efficiency of a propeller is assumed, the thrust obtainable can be calculated from the formula:

$$T = \frac{550 \times H \times E_p}{V}$$

where T = thrust in lbs., H = the brake horse-power of the engine,  $E_p$  = the efficiency of the propeller, expressed as a decimal, and V = the speed of the machine in ft. per second. A fair average efficiency for a modern propeller is .75.

**Cadet R. S. A.** (R.F.C.).

According to experiments carried out by Mons. G. Eiffel and at the National Physical Laboratory, there is no aerodynamical advantage in a rearward stagger, i.e., with the upper plane of a biplane set back in relation to the lower. In fact, there appears to be a slight disadvantage attending this arrangement. The reason for adopting it in the machine you mention is that by so doing the pilot obtains a better view in certain directions than would otherwise be possible.

**W. J. L.** (Weston).

Apply to the R.F.C. Recruiting Office, The Polytechnic, Regent Street, London, W.

**Anxious** (Huddersfield).

Cannot say if there are any vacancies for draughtsmen at the Admiralty; you should apply to the Director of Air Services, Admiralty, S.W., stating full particulars. To enlist as a mechanic in the R.N.A.S. apply to the recruiting office, Brook Green, Hammersmith, W.

**D. S.** (Worcester).

You can transfer to the R.N.A.S. if you are accepted to be trained as a pilot. The restriction you mention applies to unskilled mechanics.

**S. P.** (Upper Holloway).

For particulars regarding the R.F.C. Cadet Corps you should apply to Adastral House.

**E. M. G.** (Eton).

You must wait until you are 18. In the meantime study the subject as much as possible. The R.F.C. Cadet Corps is for those who are being trained as officers for the R.F.C.

**S. J.** (Chesterfield).

Apply to Adastral House, E.C., for particulars. If you are given an interview you may be required to produce your birth certificate and registration card.

**A. D. P.** (Dunston).

Eighteen is the minimum for both the R.F.C. Cadets and the R.N.A.S.

**A. H.** (Charlton).

There appears to be no reason why you should not apply for a commission. We understand there will be no vacancies till June. There is no reason to join the wireless section if you can get a commission as flying officer.

**V. A.** (Market Bosworth).

Certainly apply to Adastral House, although there is no object in worrying about it until you are old enough, as the conditions may be altered by that time.

**W. W.** (Southsea).

You would receive pay at the rate of 10s. per day plus 4s. per day flying pay while you are a probationary Flight Officer under training. When you graduate you will receive a further 4s. per day flying pay.



# THE CASE FOR THE LARGE AEROPLANE.\*

By F. HANDLEY PAGE, A.F.A.E.S.

## SECTION I. General.

THE question of aeroplane size is a most important one. It raises the whole question as to whether there is, or is not, a limitation to aeroplane size, and therefore whether progress in construction will be limited to improvement on present-day small types of machines, or whether there is an infinite possibility in the extension of designs to much larger types.

It has been argued by many that, just as ships, trains, and other machines for transport purposes increase in size as years go on, so will the aeroplane progress, and that the large aeroplane will have a definite place in the field of aviation. Others have adopted the opposite view.

The general consideration in favour of the large machine is that although there is a heavier initial capital outlay, large machines are much cheaper to build, cheaper to maintain, and cheaper to run than small ones, and thus progress is seen in every type of mechanical transport towards the employment of larger and larger machines with a view to taking full advantage of the economies effected.

In an aeroplane there could, however, be no advantage in the use of large machines if that increase in size gives a disproportionate increase in weight which would more than nullify constructional advantages, or if the large aeroplane had aerodynamical disadvantages. The whole case needs most careful examination from all points of view.

In the arguments set forth below I have endeavoured to compare machines of different size and review their relative advantages, determining first of all bases of comparison to enable a true picture to be obtained. As these necessitate the explanation of a new method of aerodynamical comparison, I have set this forth at rather greater length than is necessary for the development of the argument proper. After a discussion of the aerodynamical problem, I have dealt with the effect on structural weight of an increase in the size of aeroplane, and then turned back to find the effect on the aeroplane's performance of the weight variation with size increase. Lastly, there are a few notes on the large machine from a flying standpoint. It is a matter of some difficulty to obtain a true basis of comparison from pilots' opinions. Pilots are, as General Brancker remarked in his paper, a very conservative body, opposed to innovation, and the machine of the moment's design is not necessarily the one of the future, or the one from which future machines will be developed.

## SECTION II. Aerodynamical Bases of Comparison.

To determine the calculated performance of any machine, it is necessary to have available the wind-channel experiments on the lift and lift/drag of a large number of planes as well as the resistance for various types of bodies similar to that proposed to be used. The curves of lift and lift/drag are usually plotted in absolute units and in the form shown in Fig. 1.

From these wind-channel curves the performance curve of the whole machine is obtained.

After the general details of a machine's design are settled, such as the weight to be carried, the area of the planes, &c., the plane resistance at various speeds is found from the lift and lift/drag curves. To these values are added the correct ones for body resistance, the values of the two curves added together and the total horse-power required calculated for different speeds. When the engine power and propeller efficiency are known the curve of available horse-power can be plotted and the points of intersection of the two horse-power curves mark the limits of aeroplane speed variation.

It is quite easy to see that this method, although exceedingly useful for any particular aeroplane, does not afford a quick means of comparison between a machine with planes of different section or different shape or loading. I have therefore adopted a different method of plotting so that the performance of any machine can be directly predicted from the wind-channel tests, on the lift and lift/drag of the planes used, and on the body resistance, the new method taking into account the effect of altered loading or varying air densities at various heights.

I will deal first of all with the plane calculation.

The following is the notation adopted:—

$V$ —velocity of the aeroplane in feet/seconds.

$W$ —total weight in lbs. of the aeroplane.

$A$ —area of main planes in square feet.

$L$ —density of the air in lbs. cubic feet.

$g=32.2$ .

$K_y$ —absolute value of the lift coefficient.

$K_x$ —absolute value of the drag coefficient.

$R_b$ —total body resistance in absolute units per foot per second of the aeroplane considered, i.e., resistance of the chassis, body, struts, in fact all the resistance of the aeroplane except that of the planes.

The following equations may be written:—

$$W = K_y \cdot \frac{\rho}{g} \cdot A \cdot V^2 \quad (1)$$

whence 
$$V = \frac{1}{\sqrt{K_y}} \cdot \sqrt{\frac{W}{A} \cdot \frac{g}{\rho}} \quad (2)$$

or 
$$V = a \cdot \frac{1}{\sqrt{K_y}} \quad (3)$$

where 
$$a = \sqrt{\frac{W}{A} \cdot \frac{g}{\rho}} \quad (4)$$

$$\text{Resistance} = K_x \cdot \frac{\rho}{g} \cdot A \cdot V^2 \quad (5)$$

$$\text{h.p.} = K_x \cdot \frac{\rho}{g} \cdot \frac{A}{550} \cdot V^3 \quad (6)$$

Inserting the value of  $V$  from equation (2) above

$$\text{h.p.} = K_x \cdot \frac{\rho}{g} \cdot \frac{A}{550} \left( \frac{W}{A} \cdot \frac{g}{\rho} \right)^{\frac{3}{2}} \quad (7)$$

Whence 
$$\text{h.p.} = \frac{K_x}{K_y} \sqrt{\frac{1}{K_y}} \cdot \frac{W}{350} \sqrt{\frac{W}{A} \cdot \frac{g}{\rho}} \quad (8)$$

or 
$$\text{h.p.} = b \cdot \frac{K_x}{K_y} \sqrt{\frac{1}{K_y}} \quad (9)$$

where 
$$b = \frac{W}{350} \sqrt{\frac{W}{A} \cdot \frac{g}{\rho}} \quad (10)$$

Summarising

$$V = a \sqrt{\frac{1}{K_y}} \quad (3)$$

$$\text{h.p.} = b \frac{K_x}{K_y} \sqrt{\frac{1}{K_y}} \quad (9)$$

Instead of the usual  $K_x$  and  $K_y$  curves for a plane there will now be plotted

$$\sqrt{\frac{1}{K_y}} \text{ and } \frac{K_x}{K_y} \sqrt{\frac{1}{K_y}}$$

which is equivalent to plotting horse-power required against velocities. A curve for the section known as R.A.F. 6 and one for the section known as R.A.F. 3 have been plotted out in this way. It is well to examine these curves to see their general application before proceeding to deal with the question of plane comparison. In Fig. 4 are plotted the ordinary  $K_x$  and  $K_y$  curves for R.A.F. 6 and R.A.F. 3. R.A.F. 6 has the lower value of  $K_y$  maximum and a higher value for

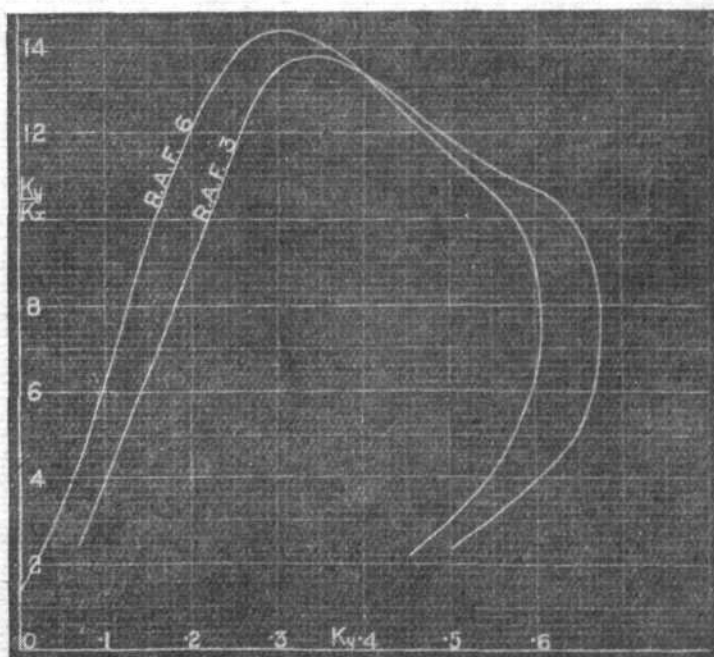


Fig. 1.

\* A paper read before the Aeronautical Society on February 7th, 1917.

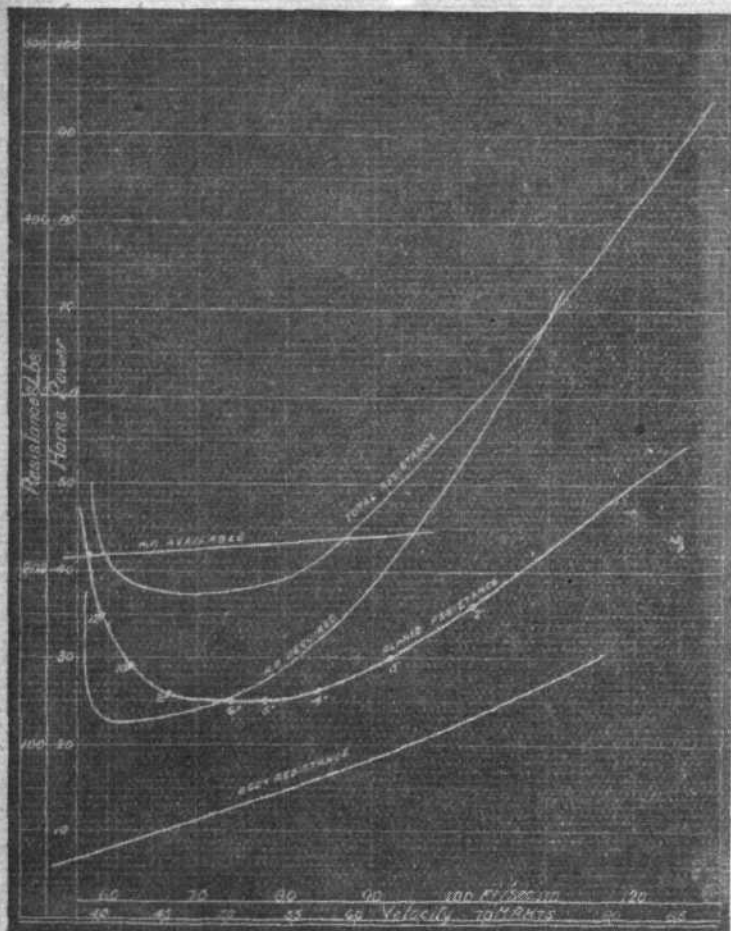


Fig. 2.

$Ky/Kx$ . The maximum value of  $Ky$  for R.A.F. 6 is .605, and that of R.A.F. 3 is .695. The result of this is reflected in the curves in Fig. 3 where R.A.F. 3 gives a slower landing speed than R.A.F. 6 for the same loading. The slow speeds are related in the ratio of the square root of their maximum  $Ky$  or in the ratio of 1 to 1.05. These plotted curves give them the relationship between horse-power and velocity for equal loading. If it is desired to know the actual speeds obtained with different horse-power or in effect to obtain the correct scale for these curves, it is only necessary to obtain the multiplying factor, converting the horizontal scale into feet per second and the vertical scale into horse-power. This is done by evaluating the constants  $a$  and  $b$  in equations 4 and 10 above, inserting therein the correct valuation of  $W$ ,  $A$  and  $\rho/g$ .

Attention is drawn to the fact that the loading expressed in weight per unit of area, and the value of the density of the air expressed as weight per cubic unit of air, appear in the same form in both velocity and horse-power multiplying factors. It follows, therefore, that these curves are correct for any loading or height above ground level, the comparison between the two being correct as long as the loading is equal in both cases. The only alteration is the multiplying factor of the horizontal and the vertical scales.

It is hardly correct, however, to compare two machines, one of which has a slower landing speed than the other. For correct comparison the slow landing speed of a machine fitted with planes to R.A.F. 3 section should be increased so that it is the same as that for R.A.F. 6. The area of the R.A.F. 3 planes should be decreased, thus increasing the loading until the two slow speeds are identical. The loading is increased in the ratio of 1 to 1.05. To compare the resulting curves it is better to keep the multiplying factors of the vertical and horizontal scales the same and alter the R.A.F. 3 curve. Since the loading enters into the multiplying factor of the horse-power and velocity scales equally each value of the R.A.F. 3 curve must be increased 1.05, both as regards horse-power and velocity. A new curve is now obtained for R.A.F. 3 having the same slow speed as R.A.F. 6 and the multiplying factors being the same for both. These new curves will again be true for all heights.

We will take an actual practical example. Assume a machine weighing 2,200 lbs. with a loading of 5.9 lbs. per square foot and that at the ground  $\rho/g = 425$ . Then from equation (4)  $a = 50$  and from (5)  $b = 200$ . For R.A.F. 3 the value of  $Ky$  (maximum) is .675, and of  $1/\sqrt{Ky}$  is 1.215.

For R.A.F. 6 the value of  $Ky$  (maximum) is .605 and of  $1/\sqrt{Ky}$  is 1.285. The slow landing speed of R.A.F. 6 for the loading of 5.9 lbs. per square foot is  $50 \times 1.285 = 64$  ft. per second or 43.5 miles per hour. The slow landing speed of R.A.F. 3 for the loading of 5.9 lbs. per square foot is  $50 \times 1.215 = 60.5$  feet per second or 41.2 miles per hour.

The new curve for R.A.F. 3 will be for a slow landing speed of 43.5 miles per hour, and the loading will now be  $43.5 \times 5.9 = 6.25$  lbs. per square foot. Each point on the old R.A.F. 3 curve must have its vertical and horizontal value increased in this proportion, i.e., multiplied by 1.05. The new R.A.F. 3 curve was plotted in this way.

The minimum height of either of these curves above the horizontal is the minimum horse-power required by the planes, and, neglecting body resistance, the curve with the minimum value will have the highest climbing speed. It must always be borne in mind that the curve with the higher loading will have the smaller planes and therefore weigh less. Allowance must be made for this in effecting the comparison.

The three curves can now be compared. For the same loading and horse-power available R.A.F. 3 has the slower landing speed, the higher climbing rate, but the slower top speed. If the loading be increased R.A.F. 3 loses its advantage in climbing rate, and does not attain the same high speed as R.A.F. 6. In a similar manner any other or more modern planes may be compared.

It is interesting to note, in passing, that at 10,000 ft. height where  $\rho = .055$  the value of  $a$  will be increased to 59 and of  $b$  to 236. The effect of height is to reduce the horse-power required for any given speed, and also the speed range by increasing the slow speed. Owing to the horse-power scale being increased the minimum horse-power required for flight is increased, and, therefore, quite apart from reduced engine horse-power, the excess horse-power available for climbing is reduced.

The general range of velocities for a high-speed machine is from 50 to 130 miles per hour or 73.5 to 190 ft. per second. In general the value of  $1/\sqrt{Ky}$  will lie between 1.4 and 3.8.

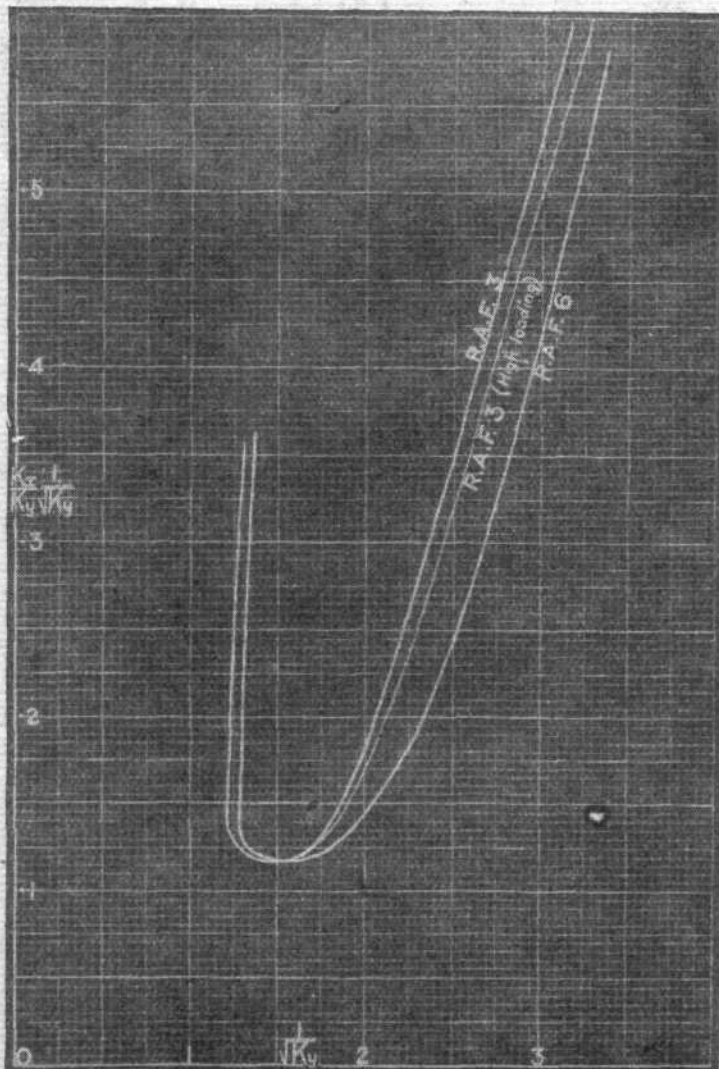


Fig. 3.



For a slow-speed machine flying from 40 to 90 miles per hour or 59 to 132 ft. per second  $1/\sqrt{Ky}$  will vary between 1.1 and 2.7. Any comparison between plane curves must be made between the velocity limits of the type of machine considered.

So far the comparison has only been extended to the planes of a machine. The body resistance remains to be dealt with.

The equation may be written:—

$$\text{Resistance} = Rb \cdot \frac{\rho}{g} \cdot V^2 \quad (11)$$

$$\text{h.p. required} = Rb \cdot \frac{\rho}{g} \cdot \frac{V^3}{550} \quad (12)$$

This equation is identical in form with the plane horse-power curve. The term  $Rb$  is the product of the values of a resistance coefficient  $Kxb$  and a body area  $S$ . The equation may therefore be written:—

$$\text{h.p. required} = Kxb \cdot \frac{\rho}{g} \cdot \frac{S}{550} V^3 \quad (13)$$

Whence inserting the value of  $V$  in equation (2) above

$$\text{h.p. required} = \frac{Ky}{Kxb} \sqrt{\frac{1}{Ky}} \cdot \frac{S}{A} \cdot \frac{W}{550} \sqrt{\frac{W}{A} \cdot \frac{g}{\rho}} \quad (14)$$

The horse-power required for body resistance can be plotted to the same scale as those for the planes. The values would be divided by

$$\frac{W}{550} \sqrt{\frac{W}{A} \cdot \frac{g}{\rho}}$$

There would then be plotted for the body resistance horse-power the value of:—

$$\frac{Ky}{Kxb} \sqrt{\frac{1}{Ky}} \cdot \frac{S}{A} \quad (15)$$

The horse-power required for body resistance can now be added to the plane horse-power curves. Let us assume that the machine referred to in paragraph 10 above requires 10 h.p. to overcome body resistance at 100 ft. per second. The curves referring to the planes in Fig. 3 have been plotted again in Fig. 4. Below the horizontal line has been added a curve of horse-power required to overcome body resistance, the scale of horse-power being the same as that for the planes. The total height between the two curves for any value of  $1/\sqrt{Ky}$  gives the total horse-power required at that speed. It is interesting to note that these curves are correctly placed in respect of one another for all heights. This method of plotting and the curves so obtained give the necessary basis for a comparison between different machines, and reference will be made to them again later in the paper, after discussing the structural side of the question.

### SECTION III. The effect of an increase in size on the structural weight of aeroplanes.

Attention has already been drawn to the fact that an improvement in the aerodynamical qualities of the machine as the size increases may be partially or completely nullified if the increase in size is accompanied by a disproportionate increase in weight. I will, therefore, accordingly examine the rate at which the weight increases with increase in size.

In this discussion we shall leave out the weight of the power unit comprising engine, tanks and fuel, as well as the useful load, whether consisting of men or dead weight, such as guns, bombs, &c. We will confine our argument to the weight of the machine structure, that is, the portion which supports the load, whether on the ground or in the air, with the necessary directing surfaces and their attachment to the main portion of the aeroplane. In the latter category come the planes, the fuselage and the chassis, and these will be considered seriatim.

In all discussions on weight-saving there is the general question as to the best utilisation of materials with the varying size of machines. As the machine is made smaller, so eventually a limit is reached beyond which it is not possible to decrease the minimum thickness of the material and retain adequate local strength. Especially is this the case in aeroplane work, where the members are usually stressed as struts, and for which, therefore, a hollow tubular construction is the most efficient form from the point of view of minimum strength for a given weight. In making tubular members, whether these be plane spars, fuselage, struts, or longerons, it is not advisable to decrease the thickness of the walls below  $\frac{5}{16}$  in. to  $\frac{1}{4}$  in. Even this is on the small side when allowance is made for errors in workmanship, and the fitting in of the necessary tongue piece to make a secure joint. Considerable economies can be effected in weight-saving with increase in size in this manner.

Local strength, too, determines the construction of

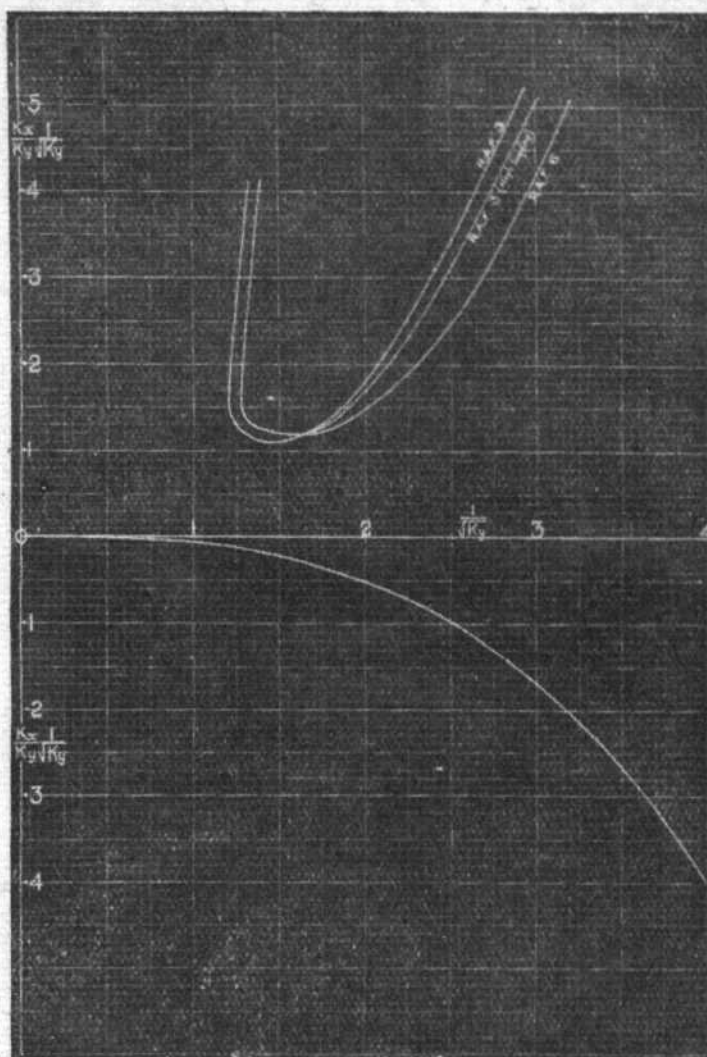


Fig. 4.

subsidiary parts of the machine, such as the tail skid, the ribs, tail planes, a local strength that does not need to be increased with increase in size of the machine, and here again weight economy can be effected.

This better utilisation of material more than offsets the increase in weight that would occur in the planes provided that they were increased in a geometrically similar manner and the loading aspect ratio and section kept the same. In a machine of which I can show you the photos later, the plane weight per square foot is less than a small one for the same factor of safety and the total plane weight is a lesser percentage of the gross weight.

The fuselage weight, owing to the better utilisation of material, is considerably decreased. The chassis weight remains about the same.

### SECTION IV. The effect of an increase in size upon an aeroplane's performance.

A general comparison can now be effected between aeroplanes of different sizes on the basis of the curves described in Section II, the total weight of the aeroplanes considered being modified according to the size in accordance with the conclusions of Section III. An examination of equation No. 6, in which horse-power equals  $b \times Kx/Ky \times \sqrt{1/Ky}$ , shows that provided that similar planes are used and that the weight per horse-power remains the same, the same plane curve represents all machines. These curves, as plotted are, in fact, curves of horse-power required per lb. weight of the machine for a given loading per square foot. Let us now examine the lower curve of horse-power required for body resistance and refer to equation 14. Provided that the area of the body increases in the same ratio as the plane area, this lower curve will still, for any size of machine, be correct in relation to the plane curve plotted above, and the summation of the two ordinates or the distance between the two curves will represent the total horse-power required, the scale being increased in proportion to the increase in ratio. The greatest resistance of an aeroplane is that of the body. This for smaller shaped bodies would increase as the square of its lineal dimensions, whereas its volume would increase as the cube. It follows, therefore, that the resistance of the



*fuselage* per unit of volume will decrease with the increase in size of the aeroplane. The lower curve will have to be modified to meet these changed conditions, and the dotted curve in Fig. 3 indicates the way in which the new curve will be plotted. This decrease in weight will have the usual cumulative effect of decreasing the weight of all the rest of the machine.

The curves which are plotted are for horse-power per unit weight of the whole machine, and do not show so graphically the superiority of the large machine as if the curves of horse-power per unit of useful weight had been plotted instead of gross weight. In this case the curves for planes and body would have their vertical ordinance increased with the proportion of useful to total weight. The balance in favour of the large machine is thus apparent directly we compare machines of approximately the same total weight per horse-power.

The conclusion that may be drawn from the above theoretical considerations of the aerodynamical and structural qualities of the large machine are that for the same total weight carried per horse-power the big machine will effect the better performance.

#### SECTION V. *The large machine from the pilot's standpoint.*

There has been very much less experience in the flying of large machines than with small ones, and therefore pilots are not so accustomed to their use, neither is the experience wide enough to draw general conclusions. It may, however, be safely said that large machines can be built to operate quite as easily and fly with as little fatigue as the best of the small ones. No Servo-motors are required for the controls provided the controlling surfaces are properly balanced. There is less work in flying a large machine owing to the wind gusts which seem large to a small machine, being relatively small in their effect on a large one. A large machine will plough its way through gusts without any control being necessary, whereas a good deal of warping might be necessary on a small machine. The large machine can be handled more easily on the ground and can alight in smaller places.

When considered from the point of view of load to be carried or long distance to be flown, the large machine has it all its own way. Where a large load is to be carried the size of the machine to do it must be increased until the useful load is

sufficiently great. The size of the machine that is required for the purpose depends on the total weight per horse-power that can be carried. There is here no question of competition between large and small machines, it is a case of the correct machine for the purpose.

For future commercial developments the large machine scores with plenty of room for passengers to sit in comfort or mails or luggage to be carried, and with its steadier movement will afford greater comfort to those who travel by it. It is probable that commercial aeroplane work will be undertaken for long distance journeys. Where delays at the commencement of the journey are a large percentage in time of that necessary to complete the distance, the possible time taken to traverse a given space may be as great or even greater than that taken by a more certain means of transit. It is the old question of the hare and the tortoise. Where, however, the distance to be traversed is great, such as 1,000 to 2,000 miles, or with journeys such as crossing the Atlantic, the passengers or mails could afford to wait a day or two and will accomplish the journey far quicker than any other means of transit. Were the commercial development of aviation confined to journeys of from 50 to 200 miles, delays at starting or the cost of organising to prevent them would cause the aeroplane's use to be considerably nullified.

It is this question of certainty in operation that requires careful attention, for it is the one thing at the present time that the aeroplane requires in order that it may take its proper place in commercial work. Engines for this will probably be more heavily built to reduce the possibility of breakdown, and multi-engine machines will be used which can fly satisfactorily even if one engine breaks down. Here again this points to the use of the larger machine.

Finally, it must be pointed out that the same improved performance can be obtained from a large machine, whether for scouting, fighting, or weight carrying, provided that the specifications are the same in both cases. It is absurd to compare the performance of a weight-carrying machine with high values of useful weight per horse-power with a small scout of very small useful weight per horse-power, and particular attention is therefore drawn to the methods of comparison set out in Section 2, so that careful comparison may result.



#### The Work of the R.F.C.

TRIBUTE to the excellent work of the Royal Flying Corps is rendered in a report written on February 4th by a company commander in the 31st German Infantry Regiment, belonging to the 18th Division, which was captured by our troops North of the Ancre. Describing the bombardment of his trench from 11 a.m. to 5.30 p.m., he says:—

"Enemy airmen were over our position the whole day and came down very low. They directed the fire throughout. Our own artillery seems to have fired very little. German airmen appeared only towards evening, but the enemy's airmen would not let themselves be disturbed in their work. Nothing is left of the trench."

#### Ministry of Munitions and Petroleum Supplies.

THE Minister of Munitions has established a Petroleum Branch in the Ministry, to be known as the Munitions Petroleum Supplies Branch, to deal with questions of the provision and distribution of petroleum and similar mineral oils for the purposes of the Ministry of Munitions. Mr. E. Houghton Fry will act as Director of the Branch. In connection with the investigation and development of hitherto unproved home sources of supply of mineral oils, the Minister will have the advantage of the services of Sir Boverton Redwood as Director of Munitions Petroleum Research. Sir Boverton Redwood will have charge of the Research Section, including the development of the British sources of supply. In accepting this position, Sir Boverton Redwood, who has been honorary adviser on petroleum to the Government for many years, has stipulated that he is to receive no payment for his services. Professor John Cadman, C.M.G., President of the Institute of Petroleum Technologists, has been good enough to assist in the organisation of arrangements with the Scottish Shale Distilleries during the war, with a view to a considerable increase in their output. Sir George Beilby is also assisting in an advisory capacity.

#### A Thrilling Adventure.

WRITING from the British Headquarters under date of February 6th to the *Daily Telegraph*, Mr. Philip Gibbs tells a very absorbing story of how two R.F.C. officers brought back a hopelessly damaged machine, but if the tale is true in substance we can only conclude that some of the details have got a little mixed in the telling. He says:—

"The number and the high audacity of our men's adventures would need a book to tell, even for one month's record—

and so little is told. Yet one that happened a few days ago is of extraordinary interest. Two of our officers were leading an offensive patrol, when a high explosive shell burst just behind the right lower wing of their aeroplane. The machine was completely riddled. Three tail booms were cut, one blade of the propeller was blown away, and all the controls except the elevator were put out of action, so that the aeroplane became uncontrollable. The junior officer of the two saw that he must act quickly to prevent a crash. He climbed out three-quarters of the way to the tip of the right wing in order to balance the machine, and at 900 ft. above the earth steadied it. At 200 ft. the machine began to spin again, but by another balancing trick on the wing the pilot and observer were able to land in safety."

#### A German Dodge.

A SMALL German balloon, to which were attached 50 newspapers printed in the French language, fell on the trees near the Petit Palais, in the Champs Elysées, at 7 p.m. on the evening of the 7th inst. It was secured and handed over to the military authorities.

#### The Raids on Saarbrücken.

A SPANIARD who, after living in Saarbrücken for a number of years, recently arrived in Zurich, has given the following account of the raids on that place to a representative of the *Daily Mail*:—

"French and British naval aircraft have made eight night attacks on Saarbrücken. I went through them all, but the first was the most terrifying, for the bombs fell in various parts of the town causing a great panic and killing and wounding large numbers of people. Sirens were sounded to announce the second raid, which made matters worse, for the town was in a panic before the enemy arrived. As a matter of fact on that occasion, and in all the later attacks, the town was not bombarded, only the blast furnaces at Burbach (a suburb) were attacked.

"Judging by the numbers of workmen who were out of work for some time after each raid, the damage must have been considerable. The Germans have 12 batteries round the town, but they were quite useless, as there are no searchlights, and the gunners were simply firing at the sky. The airmen swooped down very low, but even then it was almost impossible to make them out."



# The British Air Service

"PER ARDUA AD ASTRA"

UNDER this heading are published each week the official announcements of appointments and promotions affecting the Royal Naval Air Service and the Royal Flying Corps (Military Wing) and Central Flying School. These notices are not duplicated. By way of instance, when an appointment to the Royal Naval Air Service is announced by the Admiralty it is published forthwith, but subsequently, when it appears in the LONDON GAZETTE, it is not repeated in this column.

## Royal Naval Air Service.

*Admiralty, February 6th.*

G. W. Lester, W. T. Passmore, and A. A. Scott, granted temp. commissions as Lieut., R.N.V.R., all with seniority Feb. 5th.

T. A. Ellis and A. D. Newbury granted temp. commissions as Sub-Lieut., R.N.V.R., with seniority Feb. 5th.

E. D. Jones entered as Temp. Wt. Offr., sec. grade, to date Feb. 12th.

*Admiralty, February 7th.*

Flight-Lieuts. G. H. Jackson and L. H. F. Irving appointed Actg. Flight-Coms., to date Jan. 24th.

Temp. Flight-Lieuts. F. W. Merriam and C. H. Hayward appointed Temp. Actg. Flight-Coms., to date Jan. 24th.

Flight Sub-Lieuts. (Temp.) P. A. F. Belton, and A. W. Williams appointed Temp. Actg. Flight-Lieuts., to date Jan. 18th and Jan. 24th respectively.

E. Sturmer entered as Prob. Flight Offr. (Temp. service), to date Feb. 11th.

*Admiralty, February 8th.*

Flight-Com. R. H. Muloch, D.S.O., reappointed as Actg. Squadron Com., to date Feb. 6th.

Flight-Lieut. T. C. Vernon and Temp. Flight-Lieuts. B. C. Bell, H. S. Neville, and S. J. Goble, D.S.C., reappointed as Actg. Flight-Coms., to date Feb. 6th.

Temp. Flight Sub-Lieuts. M. J. Golding and L. Edwards reappointed as Actg. Flight-Lieuts., to date Dec. 28th and Dec. 24th respectively.

## Royal Flying Corps (Military Wing).

*London Gazette, February 6th.*

**Flight Commanders.**—From Flying Officers.—1st Jan.: Capt. L. Wanless O'Gowan, Sco. Rif.; Capt. J. A. Dennistoun, 8th Can. Inf. Bn.; Lieut. (Temp. Capt.) F. P. Don, Sco. Horse Yeo. (T.F.), and to retain his temp. rank whilst so empld. From Flying Officers, and to be Temp. Capt. whilst so empld.: Lieut. A. T. Williams, R.W. Kent R.; 2nd Lieut. (Temp. Lieut.) R. S. McClintock, W. Lan. Brig., R.F.A. (T.F.); Lieut. L. G. S. Payne, Suff. R.; Lieut. E. E. Barnes, R.E., S.R.; Temp. 2nd Lieut. (Temp. Lieut.) T. A. Oliver, Gen. List; Temp. 2nd Lieut. (Temp. Lieut.) A. D. Pearce, Gen. List; Lieut. L. J. Bayly, R.A.; Temp. 2nd Lieut. J. N. MacRae, Gen. List; Temp. 2nd Lieut. B. E. Baker, Gen. List; Temp. 2nd Lieut. H. L. Chadwick, Gen. List; Temp. 2nd Lieut. C. Seedhouse, Gen. List; Temp. 2nd Lieut. F. H. Coleman, Gen. List; 2nd Lieut. J. S. Beatty, S.R.; 2nd Lieut. A. K. Tylee, S.P.; Temp. 2nd Lieut. L. L. Richardson, Gen. List; 2nd Lieut. R. J. Bennett, S.R.

**Flying Officer.**—Temp. 2nd Lieut. C. G. Lush, R.W. Kent R., from attd. R.W. Kent R. (T.F.); Dec. 31st.

**Equipment Officers, 2nd Class.**—Lieut. C. St. Noble, S.R., from the 3rd Cl.; Sept. 26th. Dec. 1st: Temp. Capt. F. R. Williams, Gen. List, from the 3rd Cl. From the 3rd Cl., and to be Temp. Lieuts. whilst so empld.: 2nd Lieut. K. D. G. Collier, S.R.; 2nd Lieut. H. A. Browne, S.R.; 2nd Lieut. E. L. P. Morgan, S.R.; 2nd Lieut. L. Bawn, S.R.; 2nd Lieut. I. N. Dracopoli, S.R.; 2nd Lieut. (on prob.) C. A. Cuthbert, S.R.; 2nd Lieut. P. Young, S.R.; 2nd Lieut. E. S. Cohen, S.R.; Jan. 1st. Lieut. N. C. F. Francis, S.R., from a Staff Lieut.; Jan. 4th. From the 3rd Cl.—Jan. 10th: 2nd Lieut. R. E. H. Daniel, S.R., and to be Temp. Lieut. whilst so empld.; 2nd Lieut. (Temp. Lieut.) J. H. Rutherford, Lond. R. (T.F.), and to retain his temp. rank whilst so empld. Temp. 2nd Lieut. J. Inwood, Gen. List, and to be Temp. Lieut. whilst so empld.; Jan. 13th. 2nd Lieut. (on prob.) G. J. C. Gunn, Sco. Rif., S.R.; Jan. 25th.

**3rd Class.**—2nd Lieut. (on prob.) C. L. Hardy, S.R.; Jan. 1st.

**Supplementary to Regular Corps.**—2nd Lieut. H. R. Gillespie resigns his commn., Feb. 7th. The under-mentioned 2nd Lieuts. (on prob.) are confirmed in their rank: D. T. Steeves, T. Elder-Hearn. Frederic Arthur Shippam to be 2nd Lieut. Sept. 5th. The undermentioned to be 2nd Lieuts. (on prob.): Ernest Clive Fowler; Nov. 13th. Jan. 1st: Mark Marshall Merriman, Herbert Alfred Cole Parker. David Richardson; Jan. 8th. Denham Edgar Fodwell; Jan. 15th. The appointment of 2nd Lieut. (on prob.) Robert Crawford Steele, notified in the Gazette of Oct. 23rd is antedated to Sept. 21st.

*London Gazette Supplement, February 7th.*

**Squadron Commander.**—Lieut. (Temp. Capt.) F. F. Minchin, M.C., S.R., from a Flight-Commr., and to be Temp. Maj. whilst so empld.; Jan. 1st.

**Flying Officers.**—Temp. Lieut. S. Wyborn, Gen. List; Dec. 31st. Jan. 16th: 2nd Lieut. F. H. Astle, Ches. R. (T.F.); 2nd Lieut. G. W. Benson, W. Rid. R. (T.F.); 2nd Lieut. E. Blythe, Lpool. R. (T.F.). Jan. 17th: Temp. Lieut. H. L. Satchell, attd. R. War. R.; Temp. Lieut. P. T. Bowers, A.S.C., and to be transfd. to Gen. List; Temp. 2nd Lieut. C. W. D. Holmes, attd. Bedf. R. Jan. 18th: 2nd Lieut. R. Smith, Yorks. L.I., S.R., and to be sec'd.; Temp. 2nd Lieut. O. W. Berry, attd. K.O. Sco. Bord.; Capt. E. W. Bowyer-Bower, E. Surr. R., S.R., from a Flying Officer (Obs.), with seniority from June 10th; 2nd Lieut. (Temp. Lieut.) R. C. Allen, N. Mid. Brig., R.F.A. (T.F.); 2nd Lieut. E. F. Haylock, Essex R. (T.F.); Temp. 2nd Lieut. E. P. Morris, E. Kent R. Jan. 20th: Temp. Lieut. H. J. G. Newman, Lan. Fus., and to be transfd. to Gen. List; Temp. 2nd Lieut. H. F. McLoughlin, Gen. List; 2nd Lieut. (on prob.) A. B. Morgan, S.R. 2nd Lieut. J. Grieve, S. Lan. R., S.R., and to be sec'd.; Jan. 21st.

**Flying Officers (Observers).**—2nd Lieut. H. W. B. Rickards, R.A., and to be sec'd.; Nov. 12th. The notification in the Gazette of Nov. 28th regarding 2nd Lieut. (Temp. Capt.) H. G. Rickards, Lond. (Howitzer) Brig., R.F.A. (T.F.), is cancelled.

**Balloon Officer.**—Capt. L. V. S. Blacker, Corps of Guides, Ind. Army, Nov. 29th, but with seniority from Dec. 3rd, 1915.

**Adjutant.**—Capt. Le G. G. W. Horton, K.R. Rif. C., and to be sec'd.; Jan. 22nd.

**Equipment Officers, 2nd Class.**—2nd Lieut. (Temp. Capt.) N. M. Halcombe, Welsh Field Co., R.E. (T.F.); Dec. 16th. Temp. Lieut. S. B. Smith, Gen. List, from a Flying Officer; Jan. 23rd.

**3rd Class.**—2nd Lieut. F. A. Shippam, S.R.; Dec. 6th. **Experimental Officers, 1st Class (graded as an Equipment Officer, 1st Class).**—2nd Lieut. (Temp. Lieut.) W. R. G. Atkins, S.P., from the 2nd Cl., and to be Temp. Capt. whilst so empld.; Nov. 25th.

**3rd Class (graded as an Equipment Officer, 3rd Class).**—2nd Lieut. (on prob.) C. E. Fairburn, S.R.; Jan. 13th.

**Supplementary to Regular Corps.**—2nd Lieut. R. W. Jones resigns his commn.; Feb. 8th.

*London Gazette Supplement, February 8th.*

**Equipment Officers, 1st Class.**—Temp. Maj. S. Janson, A.S.C.; Jan. 25th.

**3rd Class.**—Dec. 13th: 2nd Lieut. (on prob.) L. G. Fenner, S.R.; 2nd Lieut. (on prob.) L. Crooks, S.R.

**Memorandum.**—Qmr. and Hon. Lieut. E. J. Parker, M.C., R.F.C. (Mil. Wing), to be Temp. Hon. Capt. whilst a Camp Commdt.; Mar. 12th.

**Supplementary to Regular Corps.**—2nd Lieut. (on prob.) W. Noble resigns his commn.; Feb. 9th.

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**Adjutant.**—Temp. Lieut. J. C. Howell, M.C., R.A.; Dec. 22nd.

**Equipment Officer, 2nd Class.**—Temp. Lieut. T. M. Rogers, Gen. List; Jan. 1st.

**Memorandum.**—Co. Qmr.-Sergt. John Edward Hall, from R. Highrs. (T.F.), to be Temp. 2nd Lieut. (on prob.) for duty with R.F.C.; Jan. 24th.

**Supplementary to Regular Corps.**—2nd Lieut. S. Whitechurch to be Lieut.; Feb. 1st. 2nd Lieut. (on prob.) J. C. Noble relinquishes his commn. on account of ill-health; Feb. 10th. The under-mentioned 2nd Lieuts. (on prob.) are confirmed in their rank: L. G. Fenner, A. B. Morgan, C. E. Fairburn, W. Sillem, C. L. Hardy, G. M. Watt, G. R. Kull. The under-mentioned to be 2nd Lieuts. (on prob.): Arthur Simeon Windsor; Jan. 20th. Edward Dodson; Jan. 23rd. L. V. Rothschild; Jan. 30th. H. Hussey; Feb. 1st.

*London Gazette, Supplement, February 10th.*

The undermentioned to be Temp. 2nd Lieuts.:—

**For duty with R.F.C.**—Jan. 16th: Pte. F. C. Gorrings, from Can. Infy.; Pte. E. H. Jones, from Can. A.S.C.



**Flight Commander.**—Temp. Lieut. F. J. Roberts, Gen. List, from a Flying Officer, and to be Temp. Capt. whilst so empld.; Dec. 1st.

**Flying Officers.**—2nd Lieut. L. H. Hansen, Co. of Lond. Yeo. (T.F.); Jan. 5th. Temp. 2nd Lieut. R. E. Bryson, attd. Sco. Rif.; Jan. 6th. Jan. 8th: 2nd Lieut. D. L. P. S. Stuart-Shepherd, E. Lan. R., from attd. Worc. R., and to be secd.; 2nd Lieut. J. de Conway, Lovat's Scouts Yeo. (T.F.). 2nd Lieut. H. Welch, R.F.A. (T.F.), from a Flying Officer (Obs.); Jan. 11th, but with seniority from Feb. 12th, 1916. Jan. 23rd: Temp. 2nd Lieut. M. B. Cole, Gen. List; Temp. 2nd Lieut. W. A. McClatchie, Gen. List; Temp. 2nd Lieut. (on prob.) A. W. Watson, Gen. List; Temp. 2nd Lieut. (on prob.) R. Applin, Gen. List; Temp. 2nd Lieut. (on prob.) R. Clowes, Gen. List. Temp. 2nd Lieut. J. F. Manning, attd. Middx. R.; Jan. 24th. Jan. 25th: 2nd Lieut. H. Forrest, R.F.A. (T.F.); 2nd Lieut. A. G. Jones-Williams, Welsh R., and to be secd.

**Equipment Officer, 3rd Class.**—2nd Lieut. C. J. Brockbank, Gen. List; Jan. 8th. (Substituted for the notification in the Gazette of Jan. 23rd.)

**Memorandum.**—H. Izard (late Lieut., E. Afr. Native Trans.) to be Temp. 2nd Lieut. (on prob.) for duty with R.F.C.; Jan. 12th.

**Supplementary to Regular Corps.**—The undermentioned 2nd Lieuts. to be Lieuts.;—Jan. 1st: M. C. Evans, S. F. Vincent, J. A. Gibson. 2nd Lieut. M. V. Morgan relinquishes his commn. on account of ill-health; Feb. 11th.

*London Gazette Supplement, February 12th.*

**Equipment Officers, 1st Class.**—Lieut. (Temp. Capt.) J. B. Bowen, Pembroke Yeo. (T.F.) from the 2nd Cl., and to retain his temp. rank whilst so empld.; Dec. 28th.

**2nd Class.**—From the 3rd Cl.—Sept. 26th: 2nd Lieut. Temp. Lieut.) G. I. N. Deane, Tyne Electrical Engrs., R.E. (T.F.), and to retain his temp. rank whilst so empld.; Lieut.

L. Findlater, M.C., Manch. R., S.R.; 2nd Lieut. J. Brown, S.R., and to be Temp. Lieut. whilst so empld.

**3rd Class.**—2nd Lieut. (on prob.) A. O. Roberts, S.R.; Sept. 16th. Temp. 2nd Lieut. W. C. Faull, Gen. List; Oct. 7th. 2nd Lieut. G. R. Kull, S.R.; Oct. 23rd. Temp. 2nd Lieut. (on prob.) G. Lynch, Gen. List; Nov. 30th. Temp. 2nd Lieut. (on prob.) P. S. Riach, Gen. List; Dec. 5th. Temp. 2nd Lieut. (on prob.) C. H. Parker, Gen. List; Dec. 12th.

## Schools of Military Aeronautics.

*London Gazette Supplement, February 8th.*

**Instructors (graded as Equipment Officers, 1st Class).**—2nd Lieut. (Temp. Lieut.) G. A. Turner, Dorset R., S.P., from an Asst. Instr., and to be Temp. Capt. whilst so empld.; Jan. 24th. Capt. V. O. Rees, London R. (T.F.), from an Instr. (graded as an Equipment Officer, 2nd Cl.); Dec. 20th.

**Assistant Instructors (graded as Equipment Officers, 2nd Class).**—Dec. 30th: 2nd Lieut. (Temp. Lieut.) A. C. Bishop, Berks. Yeo. (T.F.), from an Equipment Officer, 3rd Cl., and to retain his temp. rank whilst so empld. From Equipment Officers, 3rd Cl., and to be Temp. Lieuts. whilst so empld.: 2nd Lieut. G. A. Turner, Dorset R., S.R.; 2nd Lieut. (on prob.) H. E. Earl, Rif. Brig., S.R.; Temp. 2nd Lieut. A. D. Bateman, Gen. List; 2nd Lieut. R. T. Lattey, S.R.; 2nd Lieut. P. Craven, S.R.; 2nd Lieut. J. McCrae, Sea. Highrs.; 2nd Lieut. C. R. Fleming-Williams, S.R.; Temp. 2nd Lieut. F. H. Hawksford, Gen. List; Temp. 2nd Lieut. J. A. Payne, Gen. List; 2nd Lieut. H. E. Jarman, S.R.; 2nd Lieut. A. C. Day, S.R.

## Wireless and Observers' School.

*London Gazette Supplement, February 8th.*

**Instructors (graded as Equipment Officers, 2nd Class).**—From Equipment Officers, 3rd Cl., and to be Temp. Lieuts. whilst so empld.—Jan. 6th: 2nd Lieut. W. H. Date, S.R.; 2nd Lieut. S. Turner, S.R.



## Casualties.

Second Lieutenant MARK DENMAN DRAPER, R.F.C., killed while flying on February 7th, aged 32, was the eldest son of the Rev. William Henry Draper, rector of Adel, near Leeds, and grandson of the late Justice Denman. He was educated at Repton School, and took up the dramatic profession, in which he had begun to make his way. In 1915 he joined the Artists Rifles, and only recently obtained a commission in the R.F.C. His brother, Captain R. F. Draper, York and Lancaster Regiment, was killed at Suvla Bay in August, 1915.

Captain ERIC T. FARROW, R.F.C., killed on February 7th, aged 19, was the only son of Mrs. Thomas Finney, of Brisbane, where he was born. He was educated at Mill Hill School and at Lausanne. On the outbreak of war he joined the Inns of Court O.T.C. and obtained a commission in the Middlesex Regiment. In October, 1915, he transferred to the R.F.C., in which he secured a commission in January, 1916. He served for eight months at the front, where he received his captaincy. He was on duty with a reserve squadron, and was about to return to France when he met with his death while flying.

Second Lieutenant JACK NICHOLSON HOLTOM, R.F.C. (posted as missing, now reported killed on October 22nd, 1916), was 23 years of age and the youngest son of Mrs. Amy Holtom, of Sutherland Avenue, Maida Vale. He received his commission in April, 1916.

Flight Sub-Lieutenant W. H. HOPE, R.N., at first reported missing on November 23rd, 1916, and now reported to have died as a prisoner of war on the following day, was born in the Argentine and educated at Bedford Grammar School. He joined the R.N.A.S. in September, 1915, having previously served a year in the ranks of the Hampshire Carabiniers. He was the younger son of the late John Hayhurst Hope, of Bedford, and previously of the Argentine, and of Mrs. Harriett Hope, of 10, Welbeck Court, Kensington, W.

Second Lieutenant EDMUND DANIELL SPICER, R.F.C. (killed in aerial action on February 1st), was 18 years of age and the younger son of Mr. and Mrs. Newton Spicer, of Auriol Road, West Kensington. He received his commission in the R.F.C. in April, 1916, and was gazetted flying officer in the July following.

Lieutenant JOHN KENNETH STEAD, Yorkshire Regiment, attached R.F.C., younger son of Dr. J. E. Stead, F.R.S., was killed on February 4th, in his 25th year. He was educated at Mill Hill and Durham University, where he studied at Armstrong College with a view to becoming a mining engineer, and was in the O.T.C. He received a commission in the Yorkshire Regiment in September, 1914, went to the front in April, 1915, and was wounded on the 29th of that month. In March, 1916, he was attached to the R.F.C., and returned to the front in the following July.

Second Lieutenant ALFRED HARMER STEELE, R.F.C., who was killed on February 4th, aged 25, was the elder son of Mr. Harmer Steele, solicitor, of Bankside, Arterberry Road, Wimbledon. He was educated at Wellington College, and after apprenticeship to Mr. Alexander Gibbs, the contractor for His Majesty's docks at Rosyth, he became an assistant engineer on the works, from which he was unable to obtain his release until July, 1916, when he enlisted in the R.F.C., and was, within a few weeks, motor dispatch riding at the front. He was recommended by his commanding officer for a commission, and was gazetted second lieutenant in November, and shortly afterwards was flying over the enemy lines and obtained his observer's "wing."

Second Lieutenant H. L. VILLIERS, Dragoons, attached R.F.C., eldest son of Mr. and Mrs. T. L. Villiers, of Shapley, Winchfield, and Colombo, Ceylon, was killed in an engagement in the air on February 4th, aged 19. He was educated at Cheam and Wellington College, and passed into Sandhurst in May, 1915. He was gazetted to the Dragoons in the



following September, went to the front in February, 1916, and was attached to the R.F.C. in November.

Second Lieutenant MARK DENMAN DRAPER, R.F.C., killed by accident at Hendon, was the eldest son of the Rev. W. H. Draper, Rector of Adel, near Leeds, whose second son, Captain Roger Francis Draper, York and Lancaster Regiment, was killed in Gallipoli on August 2nd, 1915. Lieutenant Mark Draper was 31 years of age, and for over a year was in the Artists Rifles.

Second Lieutenant ARTHUR JACKSON, R.F.C., who was on February 7th killed as the result of an aeroplane accident, was the son of the late Charles Napier Jackson and Mrs. Jackson, of 39, Heathland Road, Stoke Newington, aged 18 years.

#### Married and to be Married.

On February 5th, Flight Commander CUTHBERT EVERARD BRISLEY, R.N.A.S., son of the late G. C. Brisley, J.P., of The Pines, Umzimkulu, Natal, was married to MARJORIE BERYL DAWSON, daughter of the late Hamilton William Atherley and Mrs. Oakes, of Silverbeck, Stanwell, Middlesex.

The marriage took place on February 12th, at the Parish Church, Gorleston, of Flight-Lieutenant EGBERT CADBURY, D.S.C., R.N.A.S., youngest son of Mr. and Mrs. George Cadbury, of Bournville, Birmingham, and Miss MARY FORBES PHILLIPS, daughter of the Rev. A. FORBES PHILLIPS and Mrs. FORBES PHILLIPS, of Gorleston. The bride, who was given away by Commodore Astley Ellison, C.B., R.N., was attended by her sister, Miss Betty Forbes Phillips. Lieutenant G. H. S. Kerr, R.G.A., was best man, and the Rev. A. Forbes Phillips (who in the literary world is known as "Athol Forbes") officiated.

The marriage between WALTER DOUGLAS CULLEN, Lieutenant, East Surrey Regiment, attached R.F.C., son of Mr. and Mrs. W. H. Cullen, Mickleham Downs, Surrey, and GWENDOLEN MARGARET, only daughter of Mr. and Mrs. GEORGE W. THOMPSON, 80, Harley Street, W., will take place at St. Marylebone Parish Church, at 2.30 p.m., on Saturday.

The engagement is announced of Squadron-Commander ROBERT HILTON JONES, R.N., only son of Mr. and Mrs. Robert Jones, late of Cilmynach, Barmouth, and EILEEN, only daughter of Colonel ASTLEY ROBERTS, R.F.A., and Mrs. ASTLEY ROBERTS, Badlesmere, Eastbourne.

At St. Mary's Church, Cadogan Street, on February 12th, Lieutenant CUTHBERT DE HOGHTON, R.N.A.S., eldest surviving son of Sir James and Lady de Hoghton, of Hoghton Tower, Lancashire, was married to HELEN, only daughter of the late Major MACDONALD, of Glencoe. Lieutenant Villiers, Headquarters R.N.A.S., was best man.

An engagement is announced between Captain A. A. NATHAN, R.F.C., and PHYLLIS MARJORIE, second daughter

of the late SYDNEY CLARIS, of Rowley Bank, Arkley, and Mrs. CLARIS, of Stanmore.

The engagement is announced of Commander CHARLES RUMNEY SAMSON, D.S.O., R.N., second son of Mr. and Mrs. Charles L. Samson, of 2, Montagu Square, W., to HONOR, only daughter of HERBERT L. STOREY, Esq., J.P., D.L., of Bailrigg, Lancaster.

Lieutenant ROWLAND H. SPENCER, R.A. and R.F.C., son of the Rev. R. E. Spencer, late vicar of Willington, Maidstone, and Mrs. Spencer, was on February 3rd, at Holy Trinity Church, Bratton St. Maur, married to MARY HARRIET (MOLLY), younger daughter of Major J. W. H. THOMPSON and Mrs. THOMPSON, of 2, Southwick Crescent, W., and Bratton House, Wincanton, Somerset.

The marriage arranged between Captain W. H. DE W. WALLER, R.F.C., second son of Mrs. Waller, of Shannon Grove, Banagher, and GWENDOLIN, youngest daughter of Mr. and Mrs. JOHN LAMBERT, of Redmount, Co. Galway, took place last Saturday at Reading.

An engagement is announced between Lieutenant-Colonel and Wing Commander CLIVE WATERLOW, Royal Engineers and R.N.A.S., only son of D. S. Waterlow, J.P., and Mrs. Waterlow, Cornwall Gardens, S.W., and JOAN, younger daughter of Mr. and Mrs. CLARE, of Farlands Croft, Farnham.

#### Items.

A Memorial Service was held on February 3rd at the Church of the Holy Trinity, Queen's Gate, for Captain Humphrey Lawrence, 34th Sikh Pioneers, I.A., lost by the sinking of the "Persia" in December, 1915, and for Captain George Aubrey Kennedy Lawrence, D.S.O., R.F.A., Temporary Lieutenant-Colonel, R.F.C., killed while flying on January 28th last. They were the eldest and youngest sons of Major-General W. A. Lawrence and Mrs. Lawrence, and grandsons of Lieutenant-General R. C. Lawrence, C.B. Among those present besides the immediate family were: Lieutenant-General the Hon. Sir Herbert Lawrence, K.C.B., General Sir David Henderson, K.C.B., D.S.O., Major Hannay, R.F.C. (representing the Royal Flying Corps), Captain Segrave, D.S.O. (War Office), Captain Barnett, I.M.S., 34th Sikh Pioneers; Lieutenant R. Kennedy, R.F.C., Colonel E. B. Burton, C.B., Major-General Saward, R.A., and Colonel Duncan Pitcher, I.A. The funeral of Temporary Lieutenant-Colonel G. A. K. Lawrence took place at Brookwood on Thursday, the 1st inst., with military honours, Lieutenant-Colonel A. C. H. Maclean, R.F.C., and other officers being present, in addition to members of the family and friends.

Lieutenant ALFRED VERNON OLIVER JONES, R.F.A., attached R.F.C., of Wybourne Grange, Tunbridge Wells, who was killed on July 21st, left property of the value of £10,036.

#### Aircraft Insurance Premiums Reduced.

It was announced on Tuesday that after March 1st a discount of 50 per cent. will be allowed in respect of all premiums under the Government scheme for insurance against enemy aircraft and bombardment risks, subject to the minimum premium not being reduced below 2s. The existing rates are as under:—

	s.	d.
Private houses and their contents and buildings in which no trade is carried on .. .. .	2	0
All other buildings and their rents .. .. .	3	0
Farming stocks (live and dead) .. .. .	3	0
Contents of all buildings, other than in private houses and in premises specified below .. .. .	5	0
Merchandise at docks and public wharves, in carriers' and canal warehouses and yards, in public mercantile storage warehouses, and in transit by rail; timber in the open; mineral oil tanks and stores (wholesale) .. .. .	7	6

#### Fatal Accidents.

An inquest was held at Upavon on Feb. 3rd on Second Lieut. Taylor, who was killed by falling with an aeroplane from an altitude of about 150 ft.

The Coroner, in summing up, said the evidence seemed very clear that there was nothing wrong with the machine. There seemed no doubt that the unfortunate young officer, through an error of judgment, attempted to turn too abruptly, and thus caused the accident. The jury returned a verdict of "Accidental Death."

An inquest was held in Yorkshire on February 11th, on 2nd Lieut. D. Grossart, who was killed through his aeroplane

falling on the afternoon of February 9th. An agricultural labourer said he saw the aeroplane turn completely over, and crash to the ground in a field. He found the aviator dead inside his machine, which was in flames. A verdict of "Accidental Death" was returned.

Lieut. W. H. Segrave, R.F.C., was killed while landing at Chesterfield on the afternoon of the 13th inst. While attempting to land, apparently through engine trouble, his machine came into contact with a tree top and crashed to the ground, the pilot being killed instantly.

Lieut. H. Macmillan, R.F.C., was killed at Montrose on Tuesday. His aeroplane turned over, and, striking the ground, became on fire.

#### A Fatality at the R.A.F.

An inquest was held at Aldershot on the 6th inst. on Dr. Charles Vandeleur Burton, a scientist, employed in the Chemical Research Department at the Royal Aircraft factory. On the previous Saturday he was conducting an experiment when a siphon burst. He was immediately attended to, but died the same evening. A verdict of "Accidental Death" was returned.

#### The Ailments of Naval Pilots.

ADDRESSING the Medical Society of London last Monday on the medical organisation of the Navy, Surgeon-General H. D. Rolleston, C.B., mentioned that, among airmen, leakage of the petrol spray has caused some to become dizzy, while headache and drowsiness may be produced by exhaust gases from the engine. One airmen who had been exposed to 34 degrees of frost at a height of 15,000 ft. suffered from frostbite.



# AIRCRAFT WORK AT THE FRONT.

## OFFICIAL INFORMATION.

**British.**

*Admiralty, February 6th.*

"An attack on Bruges Harbour was carried out by naval aeroplanes on the 2nd inst. Many heavy bombs were dropped on torpedo craft in the harbour, and buildings in the docks were set on fire. The pilots experienced considerable difficulty owing to the intense cold. Another successful bomb raid was carried out on the following night, and bombs were observed to fall on the docks and railway lines. All pilots and machines returned safely."

*General Headquarters, February 6th.*

"Yesterday bombs were dropped by us on an enemy aerodrome, and considerable damage was seen to have been done. Two of our aeroplanes were brought down in air-fights, and two German machines were driven down damaged."

*General Headquarters, February 7th.*

"Bombing operations by our aeroplanes were continued yesterday with success, and many fights took place in the air. Three German machines were driven down damaged. Two of our aeroplanes are missing."

*General Headquarters, February 8th.*

"On the night of the 6th-7th inst. we dropped bombs on an enemy aerodrome with good effect. One German aeroplane was destroyed yesterday in air fighting, and three others were driven down, damaged. One of our machines is missing."

*Admiralty, February 10th.*

"On Friday afternoon an attack was carried out by naval aeroplanes on the aerodrome of Ghisteltes. A large number of bombs were dropped, which were observed to explode on the objective. All pilots and machines returned safely."

*General Headquarters, February 10th.*

"Yesterday bombs were dropped by us on a number of places of military importance, and considerable damage was done to an enemy aerodrome. One German aeroplane was destroyed in an air fight, and another hostile machine was brought down by our anti-aircraft guns."

*General Headquarters, February 11th.*

"Bombing operations were carried out by our aeroplanes with good results on the night of the 9th-10th inst., and again yesterday. One German machine was driven down in air fighting."

*General Headquarters, February 12th.*

"In the course of air fighting yesterday one German aeroplane was driven down in a damaged condition. One of our machines is missing."

**French.**

*Paris, February 7th.*

"Yesterday three enemy machines were brought down by our pilots. In this connection Lieut. Herteaux brought down his twentieth German machine, Warrant Officer Casale his fifth, and Warrant Officer Madon his sixth. Towards 11 p.m. yesterday German aeroplanes dropped several bombs on Dunkirk. There were no victims, and no damage was done."

"Salonica.—There was great aviation activity by both sides. An enemy machine fell in the enemy lines south-west of Prilep after an engagement with one of our aeroplanes."

*Paris, February 8th.*

"On Tuesday night one of our aeroplanes dropped six bombs on the military establishments of Lahr (Grand Duchy of Baden). On the same night one of our air squadrons bombarded the aerodrome of Mariakerke."

*Paris, February 9th.*

"Yesterday evening and this morning German aeroplanes twice dropped bombs on the region of Dunkirk. Four civilians were killed. The region of Frouard was also bombed. Four persons were wounded."

"It is confirmed that one of our pilots brought down a German aeroplane on the 7th near Cerny-les-Bucy (Aisne). During the night of the 7th our bombarding aeroplanes dropped bombs on the military workshops and the railway station of Berndorf, as well as on the station of Freiburg-Breisgau (Grand Duchy of Baden)."

*Paris, February 10th.*

"Last night one of our aeroplanes bombarded the railway station and barracks of Karlsruhe; the objectives were reached. The French machine, which started at 10.50 p.m., returned at 2.10 a.m. after having accomplished its mission."

"Two German aeroplanes this morning bombed the region of Dunkirk, and dropped bombs twice last night and this morning on Amiens. There were no victims at Dunkirk."

One woman was killed at Amiens. Two bombs were also dropped at Nancy, and on the region of Pont St. Vincent, a civilian was killed and four were wounded."

"During last night numerous bombardments were carried out by our aeroplanes, particularly on the blast furnaces at Rombach and Hagondange, the stations of Maizieres and Tergnier, and the railway lines and workshops in the Saar Valley, where a train was derailed and set on fire near St. Ingbert."

"Last night numerous aerial combats. Two enemy aeroplanes, including a triplane, fell in our lines after being hit by our pilots. One was accounted for by Lieutenant Guynemer, who has thus scored his thirty-first victory."

*Paris, February 11th.*

"An enemy aeroplane was brought down by our anti-aircraft guns in the environs of Verdun. Bombs were dropped on Nancy and Pont St. Vincent without result."

"In the course of numerous air-fights yesterday two German aeroplanes fell in flames, one in the enemy lines, and the other in our lines. The latter was brought down by Lieutenant Deuillin. It is the eleventh enemy machine which this pilot has destroyed. During the night of Feb. 10th-11th our bombardment squadrons carried out fresh operations in Lorraine against the factories and blast furnaces of the Sarre, Hagondange, Esch, and Maizieres-les-Metz. A fire broke out near the station of Arnaville. The Colmar aerodrome and the port of Zeebrugge were also bombed."

*Paris, February 12th.*

"It is confirmed that a German aeroplane was brought down in an air fight on Saturday in the region of Etouvelles (Aisne). Last night our squadrons bombarded the stations of Stenay, Dun-sur-Meuse, and Athies."

**Russian.**

*Petrograd, February 5th.*

"A German aeroplane which was bombarded by our fire rapidly descended into the enemy's lines north-west of Postavy (south of Dvinsk)."

*Petrograd, February 8th.*

"A hostile aeroplane dropped bombs in the neighbourhood of Jacobstadt and killed seven and wounded eight rank and file. Two of our aviators dropped bombs on the enemy's aerodrome in the town of Kobilnik (north of Narotch Lake)."

**Italian.**

*Rome, February 7th.*

"By the recent capture of the Aviator Babic, a frigate lieutenant, the Austrian aerial fleet has lost one of its best pilots. This officer took part in a great many raids on Italian territory, among others the raid on Padua. He flew over Venice on several occasions. True to Austrian mentality, Babic displays no remorse at having murdered innocent victims. For all that, he was very surprised at meeting with fair treatment at the hands of the Italians, from whom he feared reprisals for having shelled open cities."

*Rome, February 11th.*

"Two enemy reconnoitring seaplanes have been brought down in the vicinity of Saseno (an island off the Albanian coast). The four airmen and one of the machines were captured. The other machine was sunk."

**German.**

*Berlin, February 6th.*

"Enemy airmen have bombed Bruges, causing a fire in sheds there."

*Berlin, February 8th.*

"A British aerial squadron dropped bombs on the town of Bruges, which, besides destroying some houses, killed one woman and sixteen children in a school and seriously injured two adults. No damage was caused to military establishments."

*Berlin, February 9th.*

"During January our airmen, in spite of bitter cold, carried out important tasks of observation, reconnoitring, and attack. We lost in the past month 34 aeroplanes. The British, French and Russians lost altogether 55 aeroplanes, in air fights or shot down from the ground, of which 29 were observed to be brought down within the enemy's lines, while 26 fell into our hands. In addition three hostile balloons were brought down in flames. We lost no balloons."

*Berlin, February 10th.*

"During the night of Feb. 9th-10th several of our Flanders naval aeroplanes bombed the harbour and works of Dunkirk and the adjacent enemy aerodromes. Good results were observed."



*Berlin, February 11th.*

"Reconnoitring and attacking expeditions were carried out by our aviation squadrons far behind the enemy's front. Important enemy military works and depôts were effectively bombed during the day and night."

**Austrian.***Vienna, February 6th.*

"Near Comanesti [Moldavia] an enemy battle airman was compelled to make a forced landing during the course of an aerial engagement."

*Vienna, February 8th.*

"An Italian aeroplane was shot down by a patrolling gendarme in the region of Berat."

*Vienna, February 11th.*

"Italian aviators dropped bombs on Trieste, Muggia, the wharf of St. Aocco, and the field hospital of Opicina."

**Bulgarian.***Sofia, February 8th.*

"There was lively aerial activity on the entire front. Non-commissioned Officer Koenicke brought down an enemy aeroplane in the plain of Monastir. The machine fell behind our lines, and the pilot and observer were killed. Another enemy aeroplane was shot down and fell in the Gulf of Leftera."

**Turkish.***Constantinople, February 12th.*

"An enemy aeroplane was brought down by our infantry."

## SIDE-WINDS.

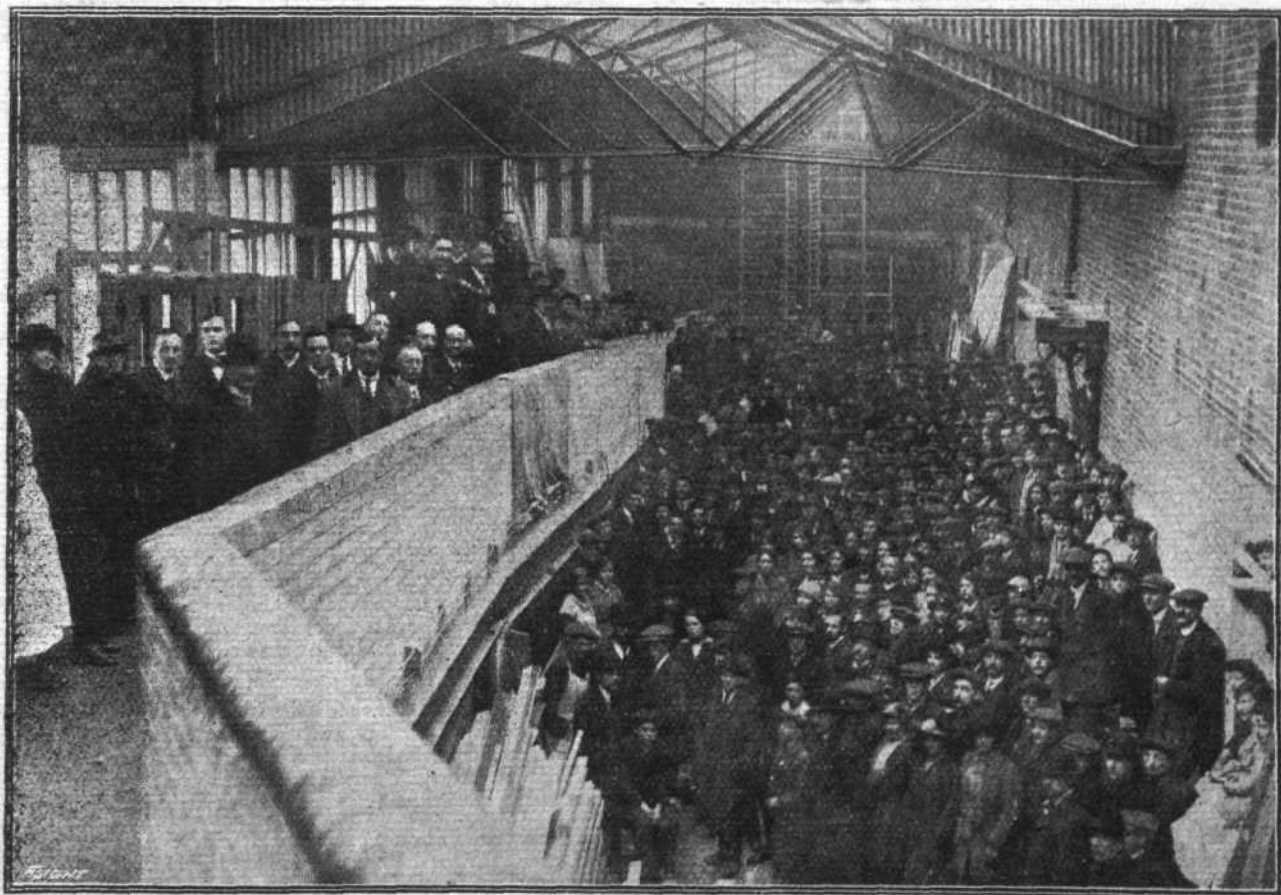
AMONG recent contributions to the War Loan may be noted M. Samuel and Co., £200,000; Waring and Gillow, £54,000; Mr. Mortimer Singer, £50,000; Messrs. Petters (Ltd.), Yeovil, £10,000; Mr. Percy Martin, £10,000.

By way of assisting their employees to subscribe to the War Loan, the directors of the Anglo-American Oil Co. arranged to purchase loan stock for them to a total amount not exceeding one-tenth of one year's salary or wages. The payment for such stock will be made by deduction from the salary at the rate of one shilling per week for each £5 of stock, and payments will be deducted for 90 weeks.

AMONG Leeds Munitions firms, where the War Savings movement has been going strong lately, one of the best records achieved for the moment has fallen to the Blackburn Aeroplane and Motor Co., Ltd. Due to the energy of a committee representative of the various shops and departments, the Blackburn War Savings Association has enlisted a membership running close on to four figures. Starting with £175, the weekly subscriptions have shown steady growth up to £250 and this week, owing to the special appeal made in connection with the War Loan, a figure round about £500 is anticipated representing a very considerable percentage of the employees' wages. Certainly the Blackburn employees are to the forefront among aviation firms for patriotism of the most

practical kind, and it is not surprising that their success has been cited by the local press as an incentive to other Yorkshire workshops to go and do likewise.

ADVERTISEMENTS have usually but one aim—to draw attention to the goods of the advertiser; but the excellent series of announcements of Messrs. C. C. Wakefield and Co. which have been appearing in these pages fulfil a double purpose, for not only do they enforce the special claims of that excellent lubricant "Castrol," but they are a continual reminder that marvellous as the development of the aeroplane has been in recent years, there are much greater possibilities in store. Some of the ideas as foreshadowed in the "Aerial Submarine in 1918," "The Aerial Motor 'Bus,'" the "Aerial Expedition to the North Pole" may sound fantastic, and the artist's conception of the idea may give rise to a smile, but it does remind us of the immense future which is in front of aviation. One of the ideas which was recently illustrated, for instance, was the mail aeroplane between London and Manchester, with the mail being dropped, by the aid of parachutes, at the intervening places. A few years back that would have been described as a dream of the future, and yet both the American and French Governments are to-day making arrangements on similar lines. Doubtless in a year or two, when such things are "all in the day's work," the details of some of these drawings may appear a little quaint, but there



**WAR LOAN DAY AT THE DAVIDSON AVIATION CO., LTD., HAMMERSMITH.**—By way of setting an example, the Directors of the Company explained to their employees the why and wherefore of the Loan, with the result that individual support by many of the workpeople was given. Mr. Forman, Mayor of Hammersmith, who is wearing his chain of office in the photograph, supported Mr. Percy L. Mott and Mr. W. E. Chester, the Chairman and Managing Director respectively of the Davidson Co.



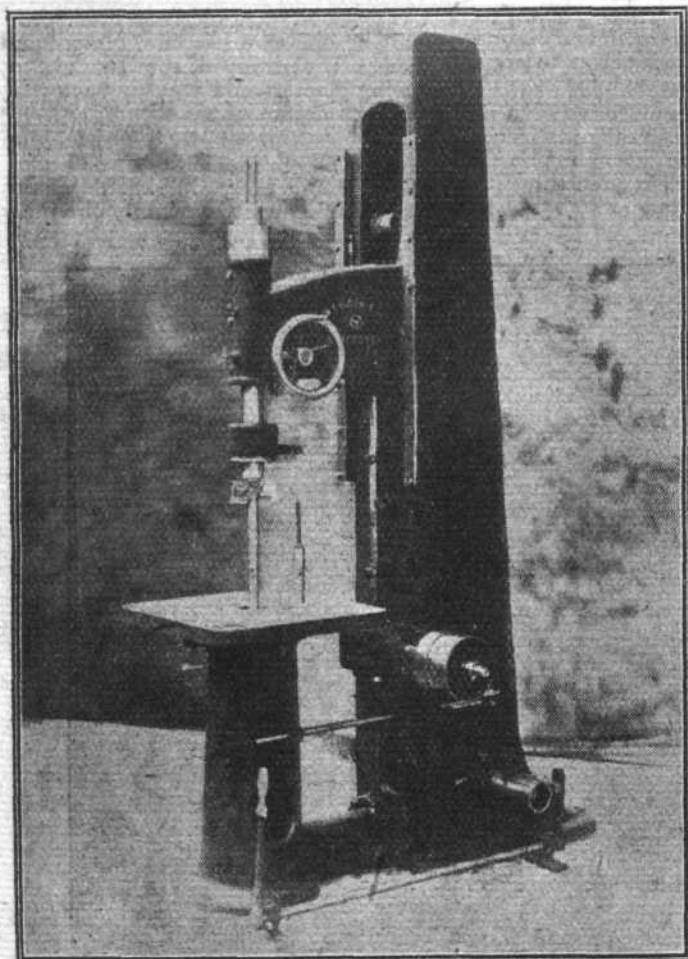
can be little doubt that as regards the main idea they will not be far out. It is an enterprise for which Messrs. C. C. Wakefield and Co., Ltd., and Mr. Frank Fisher, who is in charge of their motor and aviation department, are to be heartily complimented.

THE many friends of Mr. G. S. Mainprize, who has for some time been Office Manager of the Fairby Construction Company, will be interested to hear of his appointment to a similar position with a well-known aircraft firm in the North of England.

## A NEW PROPELLER BORING MACHINE.

ALWAYS on the alert with a view to discovering new fields that offer scope for improvement, Messrs. Wadkin and Co., Leicester, the well-known manufacturers of woodworking machine tools, have realised the urgent necessity of a machine for boring and recessing propeller hubs. An operation of this kind requires the greatest accuracy if the propeller is to run true and without flutter, and after a considerable number of experiments the conclusion has been arrived at that to successfully meet these requirements a machine must be specially designed for the job.

The manner in which Messrs. Wadkin and Co. have done this is illustrated in the accompanying photograph, which shows their new propeller boring and recessing machine. This is designed on the vertical boring bar principle, experiments having shown that this form was the most reliable for obtaining the necessary accuracy. The boring bar is mounted on a No. 4 Morse taper chuck, and has a screwed end which ensures the tightening up and centring of the



The new Wadkin propeller boring and recessing machine.

bar. A plain fly cutter is secured in a slot in the bar, and an adjustable recessing cutter-block is screwed to the bar, the position being adjustable to suit different depths of propeller hubs. The spindle that carries the boring bar runs in ball-bearings of a heavy type and carried by a balanced sliding sleeve controlled by a hand wheel.

The other end of the boring bar runs in a bush which is carried in a ball-bearing recessed into the table, and the exact depth of the recess in the propeller is regulated by a stop. The machine is very easy to operate the overhanging arm carrying the spindle being raised and lowered by power

controlled by a lever in front of the table, thus providing an easy means of setting and withdrawing the boring bar for each propeller. Another time-saving feature of the machine is that the boring and recessing are done simultaneously, thus avoiding the necessity of changing tools.

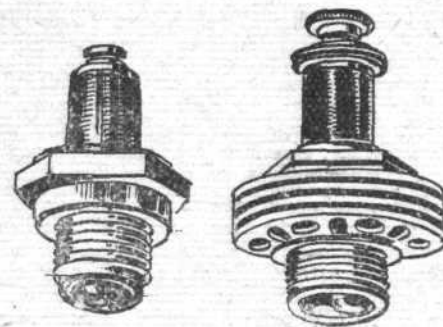
For ordinary recessing, trenching and shaping, a compound table is provided, and thus equipped the machine forms an extremely handy tool for halving in the case of three-bladed and four-bladed propellers.

## TWO "FORWARD" SPARKING PLUGS.

THE accompanying sketches show two plugs which have been produced for use on aero engines by the Forward Motor Co. of Birmingham. The smaller of the two is the type "R" for use on rotary engines. Its dimensions have been kept as small as possible

—the length being 2 ins.—and the body is of steel with a brass bushing for the central electrode. The insulation is of the finest quality mica.

In the other plug, for use on stationary engines, a somewhat unusual method of cooling has been employed. Four



circular copper washers are placed in position over the body of the plug, below the spanner grip, in between each of which is a smaller washer, so that they are kept separated and thus form cooling fins. The body of the plug is of steel, the insulation of mica, and the central electrode is bent towards the walls of the plug to form the spark gap. The overall dimensions of this plug are 1½ ins. diameter and 2¾ ins. long.

## NEW COMPANY REGISTERED.

UNITED MOTOR AND GENERAL INSURANCE CO., LTD.—Capital £100,000, in £1 shares. Insurers of all conveyances travelling on the ground, through the air, or through or under the water. First directors: A. N. Nobbs, H. Moore, A. R. Atkey, B. Coathupe, R. Winn, R. Woodbread and C. W. Phipps.

## IMPORTS AND EXPORTS, 1916-1917.

AEROPLANES, airships, balloons, and parts thereof (not shown separately before 1910). For 1910 and 1911 figures, see "FLIGHT" for January 25th, 1912; for 1912 and 1913, see "FLIGHT" for January 17th, 1914; for 1914, see "FLIGHT" for January 15th, 1915; for 1915, see "FLIGHT" for January 13th, 1916; and for 1916, see "FLIGHT" for January 11th, 1917.

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